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The Influence of Farm Machinery

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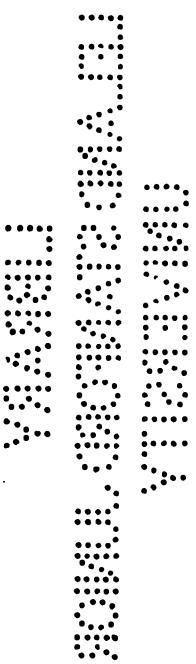
BY

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A Thesis submitted for the degree of
Doctor of Philosophy

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PREFACE

The subject of this thesis was suggested to me by my former teacher, Professor David Kinley, of the University of Illinois. Credit for helpful suggestions and inspiration is due also to Col. Carroll D. Wright, formerly U. S. Commissioner of Labor; to Professor I. P. Roberts, of Cornell University; to the members of Professor Ely's seminary in economics in the University of Wisconsin, during the school-year 1902–03; and to the members of the Publication Committee of the American Economic Association. To Professor M. B. Hammond, now of the Ohio State University, I am indebted not only for helpful suggestions made during the two years I was a student in the University of Illinois, but also for a most severe yet kindly criticism of the paper after I thought I had it finished.

In the preparation of the paper I have been careful to avoid trying to prove a theory, preferring rather to let the data tell their own story.

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PART I

HISTORICAL SURVEY

History tells of no time when farming was not a recognized occupation, when men have not toiled and sweated to wring from the soil their chief sustenance, and yet, it is only within the past hundred years that any considerable progress has been made in the invention of farm labor-saving machinery. There are scattered mentionings of earlier attempts to improve the means of doing farm work; as, for example, a passage in the writings Pliny the elder, in which he describes a machine propelled by oxen and used by the Gauls for cutting grain.[1] But such notices are rare, and whatever the merits of the various inventions, they seem not to have been perfected or at any rate not to have come into common use. The Independence of America found the farmers of Europe, as well as of this country, cultivating and caring for their crops by pretty much the same rude means and methods as were practiced by the Egyptians and Israelites three thousand years before.

As to just when the modern machine methods came into general use authorities differ and will, doubtless, continue to differ. The census statistician for agriculture makes the statement that "The year 1850 practically marks the close of the period in which the only farm implements and machinery, other than the wagon, cart, and cotton gin, were those which, for want of a

[1] "In the vast domains of the provinces of Gaul a large, hollow frame, armed with teeth and supported on two wheels, is driven through the standing corn, the beasts being yoked behind it; the result being that the ears are torn off and fall within the frame."—Pliny's Natural History; Bohn's Classical Library, Vol. IV, p. 103.

better designation, may be called implements of hand production."[1] This opinion is in substantial agreement with that of a recent German writer.[2]

The cotton gin was not invented until nearly twenty years after the Declaration of Independence was signed, and the wagons and carts of that time were crude affairs in comparison with those of the present day.[3] "The Massachusetts farmer who witnessed the revolution plowed his land with the wooden bull-plow, sowed his grain broadcast, and, when it was ripe, cut it with a scythe, and thrashed it out on his barn floor with a flail."[4] The poor whites of Virginia, in 1790, lived in log huts "with the chinks stuffed with clay; the walls had no plaster; the windows had no glass; the furniture was such as they had themselves made. Their grain was thrashed by driving horses over it in the open field. When they ground it they used a rude pestle and mortar, or, placed in the hollow of one stone, they beat it with another."[5]

"In parts of Pennsylvania, in Delaware, the eastern shores of Maryland and Virginia and, we believe, in Rhode Island grain was generally trodden out by oxen

[1] Twelfth Census, Agriculture I, p. xxix.

[2] "Andererseits ist der landwirtschaftlichen Maschinenentwickelung vor dem neunzëhnten Jahrhundert wenig Bedeutung beizumessen, da ihre praktische Anwendung mit ihr nicht Hand in Hand gegangen war. Daher kommt es auch, dass die Maschinen der vorigen Jahrhunderte alle mehr oder weniger unvollkommen blieben. Die Anwendung landwirtschaftlicher Maschinen erfolgte erst in grösseren Masstab um die vierziger Jahre dieses Jahrhunderts."—Bensing: Einfluss der landwirtschaftlichen Maschinen, p. 16.

[3] Mass. Agr. Report for 1853, p. 422.

[4] McMaster: History of the People of the United States, Vol I., p. 18.

[5] McMaster: History of the People of the United States, Vol. II, p. 14.

or horses as the more expeditious method," even later than the year 1800. "Horses were preferred for this work. A crop of three thousand bushels could thus be threshed and secured in ten days. The treading floors were from forty to one hundred and thirty feet, more commonly sixty to one hunfeet in diameter with a path twelve to fourteen feet wide near the periphery upon which the grain was laid. The horses were led round at a slow trot in platoons equidistant from each other The floors were sometimes removed from field to field, but permanent floors made hard and smooth, and kept so by careful use, were preferred. They were commonly fenced round, sometimes with an outer and inner fence."[1]

Of the Georgia estates in 1790, it is said: Their "chief products were negroes, rice, and tobacco The staple was tobacco, and this was cultivated in the simplest manner with the rudest of tools. Agriculture as we now know it can scarcely be said to have existed. The plough was little used. The hoe was the implement of husbandry. Made at the plantation smithy, the blade was ill-formed and clumsy; the handle was a sapling with the bark left on . . . Few roads were ever marked by the tires of a four-wheeled wagon or a tumbrel. When the tobacco was ready for the inspector's mark, stout hogsheads were procured, the leaves packed in, the heads fastened in, a shaft and a rude axle attached, and, one by one they were rolled along the roads for miles to the tobacco-house nearest by."[2] Michaux, who made a journey through the United States in 1802 for the express purpose of study-

[1] Preliminary Report, Eighth Census, p. 95.

[2] McMaster: History of the People of the United States, Vol. II, p. 4.

ing agricultural conditions, in speaking of North Carolina, says: "Throughout the whole of the low country the agricultural labours are performed by negro slaves, and the major part of the planters employ them to drag the plough; they conceive the land is better cultivated and calculate besides that in the course of a year a horse, for food and looking after, costs ten times more than a negro, the annual expense of which does not exceed fifteen dollars."[1]

Even so late as the year 1812, the French settlers in Southern Illinois were using plows "made of wood with a small point of iron fastened upon the wood by strips of rawhide, the beam resting upon an axle and small wooden wheels. They were drawn by oxen yoked by the horns by raw leather straps, a pole extending back from the yoke to the axle." Small plows for plowing between the rows of corn were not introduced until about the year 1815. "They used carts that had not a particle of iron about them."[2]

The Cary plow, which seems to have been a fair type of the plows used during later colonial times and until well into the nineteenth century had a "wrought iron share, wooden landside and standard, and wooden mould board plated over with sheet iron or tin and short upright handles."[3] The Old Colony plow, which was still in general use in the Eastern States in 1820, "had a ten-foot beam and a four-foot landside" and it made the "furrows stand up like the ribs of a lean horse in the month of March."[4]

[1] F. A. Michaux, Travels in America in 1802, p. 291.

[2] Mass. Agr. Report for 1873–4, p. 18.

[3] Eighth Census, Agriculture, p. xviii. Mass. Agr. Report for 1853, p. 422.

[4] Year Book, Department of Agriculture (1899), p. 315.

One plow, in particular, is deserving of notice. It is the plow which Daniel Webster, in the year 1836, designed and helped to make for the especial purpose of clearing up a certain field on his farm at Marshfield, Massachusetts.[1] It was designed to cut a furrow from 12 to 14 inches deep and has been described as being "12 feet long from the bridle (*i. e.*, clevis) to the tip of the handles; the landside is 4 feet long; the bar and share are forged together; the mould board is of wood with straps of iron; breadth at heel of mould board to landside, 18 inches; the spread of the mould board was 27 inches; the lower edge of the beam was 2 feet 4 inches above the sole; width of share 15 inches." With oxen to draw the plow and several men to help him, Webster held the handles and cleared his stump patch. Speaking of his work with this plow, Webster is reported to have said: "When I have hold of the handles of my big plow in such a field as this, with four yoke of oxen to pull it through and hear the roots crack and see the stumps all go under the furrow, out of sight, and observe the clean mellow surface of the plowed land, I feel more enthusiasm over my achievement than comes from my encounters in public life at Washington."[2]

Webster's plow, although no doubt somewhat exceptional by reason of its massiveness, as became the man, is in fact, only an illustration of what was an every-day affair. For, the blacksmith shops were the plow factories of that time, and farmers were accustomed to having their plows made to order.

It must not be supposed, however, that inventors of the regular type were unmindful of the needs of the

[1] A picture of this plow is given in Roberts: Fertility of the land, page 49.

[2] N. Y. Agr. Report, 1867, p. 484.

farming class. The Napoleonic wars, in particular, stimulated the demand of Europe for American agricultural products and our patent office records furnish ample evidence of the efforts of inventors to supply better means of cultivating and caring for such products.[1] Whitney's cotton gin patented in 1794, was only one of many devices designed to promote the business of the farmer. At least two patents for grain thrashing machines were issued as early as the year 1791.[2] A patent for a corn planting machine was issued in 1799[3] and another for a grain cutting machine in 1803.[4]

But the only one of these early inventions, other than the cotton gin, which seems to have really foreshadowed its successor of the present day, was a cast-iron plow invented by Chas. Newbold of Burlington County, New Jersey. Sometime between 1790 and 1796, Newbold had a plow cast, under his direction, at the Hanover furnace, in Burlington County, New Jersey. The plow was cast all "in one peice" and on June 17, 1797, he was granted a patent for his invention.[5] He appears to have used this first plow on his own land with much success; but, financially, his enterprise was a failure. The farmers were opposed to "new fangled notions" and contended that the use of cast iron "poisoned the land, injured its fertility, and promoted the growth of weeds." Finally the point of the plow was broken off. It was never repaired, and the plow is now in the museum of the New York State Agricultural Society at Albany,

[1] Eighth Census, Preliminary Report, p. 96.

[2] Eighth Census, Preliminary Report, p. 96.

[3] U. S. Agr. Report for 1870, p. 401.

[4] Eighth Census, Agriculture, p. xx.

[5] U. S. Agr. Report (1870), p. 395; N. Y. Agr. Report (1867), p. 448.

New York.[1] Eventually, however, the prejudice against cast iron plows was overcome. Better patterns were devised. They were adopted by the people and so late as the year 1850, according to the Census statistician for Agriculture, "The old cast iron plows were in general use. Grass was mowed with the scythe, and grain was cut with the sickle or cradle and thrashed with the flail."[2]

The prototype of the modern grain reaper had indeed appeared prior to 1850.[3] A similar statement might, doubtless, be made concerning certain other inventions for which patents had been issued; but all of these, like the submarine boat and the flying machine of the present day, were in too imperfect a state, too complex, or too expensive to meet the demands of the time. Whitney's cotton gin and Newbold's cast iron plow may, therefore, be accepted as the only ones of the great inventions which, up to 1850, had become thoroughly incorporated into the agricultural industry of this country.

Just how soon after 1850 the various other labor saving machines became essential factors in the business of farm work it would be impossible to tell. Reaping machines were fairly well developed; but the complexity of the machines and the ignorance of the farmers were serious hindrances to their general use.[4] It is only in

[1] N. Y. Agr. Report (1867), pp. 446, 448.

[2] Twelfth Census, Agriculture, Vol. I, p. xxix.

[3] Obed Hussey's machine was patented in 1833; C. W. McCormick's in 1834.—Eighth Census, Agriculture, p. xxi.

[4] "I use for reaping only the scythe and cradle. . . . Perhaps a still greater benefit may be found in the substitution of reaping machines, which, even now, are used by most of the good farmers of my neighborhood. But because of their great liability to get out of order, the difficulties of working them, and especially my own ignorance of machinery, I have feared to attempt the use of reaping machines."—Letter of Edmund Ruffin, a Virginia farmer. Patent Office Reports (1850–51), p. 104.

very recent years that agricultural implement dealers have ventured to send out any reaping machine without sending also an expert operator to instruct the purchaser in its use.[1]

The two-horse corn cultivator began to come into use in 1861.[2] There are evidences, too, that other farm machines were coming into use at that time.[3] But during the Civil War from 1861 to 1864 the minds of inventors as well as of the working classes were given to other matters.[4]

From 1866 onward progress in the invention and use of agricultural machinery has been by more rapid strides, yet even so late as the year 1870 the editor of the "New American Farm Book"[5] questioned the advisability of using the large threshing machines because of the "great loss of grain and enormous waste of straw" which were apt to result, and cautioned his readers particularly against "employing itinerate threshers, who go about the country to do work." For the "moderate farmer" he advised the use of "a small single or double horse machine or hand thresher" as the more economical and as permitting the work to be done "in winter, where there is more leisure for it."

To-day the American farmer who does not use a machine of some sort is indeed far behind the times. The farmers of the far West have profited most of all.

[1] Report of the Industrial Commission, Vol. XI, p. 78.

[2] "*Illinois Farmer*" for 1861, p. 178.

[3] Eighth Census, Preliminary Report, p. 99.

[4] The Patent Office records through the period of the Civil War show a marked decrease in the number of patents issued for agricultural implements and machines and a very great increase in the number of patents issued for firearms and other weapons of warfare.

[5] R. A. Allen's "New American Farm Book" (published in 1870), p. 150.

There, on the California and Oregon farms, may be found fifty-horse-power traction engines in operation. Each one dragging "sixteen ten-inch plows, four six-feet harrows, and a press drill for planting seed-wheat. In this way one such engine performs the triple work of ploughing, harrowing, and planting, all in one operation. The saving of time is so great that one machine can plant with wheat, from fifty to seventy-five acres in a single day, mounting hilly and rough ground just as easily as when passing across dead levels." When the grain is ripe, a harvesting machine is, by the same means, pulled across the field. "Its cutters are often twenty to twenty-six feet wide When the cutters have performed their work, automatic rakers gather in the grain stalks and carry them to rows of knives where they are at once headed. Then, in the same operation, the wheat is threshed out, cleaned and sacked, and behind the great combination harvester there is left a trail of sacked wheat ready for the market. Another traction engine with a train of a dozen cars follows in the wake of the thresher and harvester, gathering up the wheat and carting it to the granary. In this manner fully seventy acres and more of wheat land are harvested in one day."[1] With the aid of these engines the work of "plowing, cultivating, seeding, and harvesting on farms of a thousand acres in extent" may be done by half a dozen men in "much less time than a whole army of employees could do the work on a farm of half the acreage."[2] For the profitable use of such vast machine power, large fields are a self-evident necessity.

[1] George E. Walsh, "Steam Power for Agricultural Purposes," in *Harper's Weekly*, Vol. XLV, p. 567.

[2] *Cassier's Magazine*, Vol. XIX, p. 139, and Harper's Weekly, Vol. XLV, p. 567.

The farm machines in use in the Central States are less massive and of a more varied nature and yet, in the rate of progress which they show, are no less wonderful than those above described. Instead of a hoe for covering seed-corn, dropped by hand, the farmer now uses a check-row planter drawn by horses and depositing the seed at regular intervals so that the rows may be cultivated with equal facility either in the direction of the planting or across. As a means of cultivating the corn, hoes are now laid aside, and in their stead the farmer quite commonly uses a riding plow. Steam power corn-huskers and corn-shellers are found. Instead of the old hand-method of shelling corn by scraping the ears against the handle of a frying pan or the blade of a shovel, by which means hardly six bushels could be shelled in a day, the farmer may now have his corn shelled at the rate of a bushel a minute and the machine which does the work will also "carry off the cobs to a pile or into a wagon, and deliver the corn into sacks."[1]

Mowing machines, horse hay-rakes, tedders, and stackers have revolutionized the work of making hay. It formerly required eleven hours of man-labor to cut and cure a ton of hay. Now the same work may be done in one hour and 39 minutes; while the cost for the required man-labor has been decreased from 83⅓ to 16¼ cents per ton.[2] Potato planters and diggers, feed choppers and grinders, manure spreaders, and ditch-digging machines are only a few of many labor-saving devices now common on the farms in the Central States. There is hardly a phase of farm work that has not been essentially changed by the introduction of some new implement or machine.

[1] Department of Agriculture, Year Book (1899), pp. 316–318 and 332.
[2] Department of Agriculture, Year Book (1899), p. 332.

Some idea of the great development which has taken place along these lines may be gained from a consideration of the value of the output of agricultural implements and machinery as reported to the Census Office. For purposes of comparative study, the figures must be taken subject to heavy allowances, because as pointed out by Mr. George K. Holmes,[1] the prices of farm machinery have "declined to an enormous extent," and this too, in spite of the fact that the later machines are more efficient, more durable, more readily operated, lighter, and stronger.

The total value of agricultural implements and machines manufactured during the several census years, as reported to the Census Office, is as follows:[2]

Year.	*Total for United States.*
1900	$101,207,428
1890	81,271,651
1880	68,640,486
1870	42,653,500[3]
1860	20,831,904
1850	6,842,611

[1] Twelfth Census, Manufacturing, IV, p. 353.

[2] Twelfth Census, Manufactures, Vol. IV, p. 344.

[3] The amount as given in the Census Report has been reduced to a gold basis.—See Tenth Census, Manufactures, p. 1.

PART II

MACHINERY AND PRODUCTION

THE COURSE OF AGRICULTURAL PRODUCTION CONTRASTED WITH THE INCREASE IN THE POPULATION 1840–1900

The first federal census which took account of agricultural products was that of 1840. The principal crops, for the period from 1840 to 1900 as reported to the census office, were as follows:[1]

Year.	*Barley bu.*	*Corn bu.*	*Cotton bales.*	*Hay tons.*
1899	119,634,877	2,666,440,279	9,534,707	84,011,299
1889	78,332,976	2,122,327,547	7,472,511	66,831,480
1879	43,997,495	1,754,591,676	5,755,359	35,150,710
1869	29,761,305	760,944,549	3,011,996	27,316,048
1859	15,825,898	838,792,742	5,387,052	19,083,896
1849	5,167,015	592,071,104	2,469,053	13,838,642
1839	4,161,504	377,531,875	1,580,958	10,248,108

Year.	*Oats bu.*	*Potatoes*[2] *bu.*	*Rye bu.*	*Wheat bu.*
1899	943,389,375	315,854,903	25,568,625	658,534,252
1889	809,250,666	261,496,623	28,421,398	468,373,968
1879	407,858,999	202,837,232	19,831,595	459,483,137
1869	282,107,157	165,047,297	16,918,795	287,745,626
1859	172,643,185	153,243,893	21,101,380	173,104,924
1849	146,584,179	104,066,044	14,188,813	100,485,944
1839	123,071,341	108,298,060	18,645,567	84,823,272

An examination of these figures shows that the barley crop of 1899 was 28.7 times greater than the barley crop

[1] The figures for the year 1839 are taken from the report of the Sixth Census, p. 408; those for the years 1849, 1859, 1869, 1879, and 1889 from the Eleventh Census, Agriculture, pp. 87-91; those for the year 1899 from the Twelfth Census, Agriculture, Vol. I, p. cxxi. The report of cotton production for the year 1839 was reported in pounds. The figures for that year have been converted to bales on the basis of five hundred pounds per bale.

[2] Includes both Irish and sweet potatoes.

of 1839; the corn, cotton, oats, wheat, and hay crops of 1899 were from 6 to 8 times greater than they were in 1839. The population of the United States in 1900 was, however, only 4.4 times greater than in 1840.

The total production of the eight principal cereals (corn, wheat, oats, barley, rye, buckwheat, rice, and Kaffir corn), expressed in bushels, and the population, as reported by the census authorities, for the period from 1840 to 1900, has been as follows:

Year.	*Population.*		*Cereals, bu.*	
1900	75,568,686	[1]	4,434,698,746	[2]
1890	62,622,250		3,520,960,086	
1880	50,155,783		2,699,415,752	
1870	38,558,371		1,388,526,403	
1860	31,443,321		1,242,159,398	
1850	23,191,876		871,042,524	
1840	17,069,453		617,321,778	[3]

If we represent the population in 1840 and the cereal production reported in that year, each by 100 and the population and cereal production reported in succeeding census years by their per cents, respectively, of the population and cereal production reported in 1840, we shall get a new table showing the relative increase in population and cereal production for the period in question. Such a table is presented herewith as follows:

Year.	*Population.*	*Cereals.*	*Increase in cereals over increase in population.*
1900	442.7	718.4	275.7
1890	366.9	570.4	203.5
1880	293.8	437.3	143.5
1870	225.9	224.9 [246.2]	[20.3] [4]
1860	184.2	201.2	17.0
1850	135.9	141.1	5.2
1840	100.0	100.0	. . .

[1] Twelfth Census, Population, I, p. xix.

[2] Twelfth Census, Agriculture, II, pp. 64–65.

[3] Sixth Census, p. 408.

[4] See p. 15.

From these figures it appears that in 1870 the proportion of cereal product to population was slightly below the proportion existing in 1840, but that otherwise there has been an increasingly greater proportion of product to population through the whole of the period from 1840 to 1900.[1]

The comparatively light cereal crop reported in 1870 was doubtless largely due to the unusually poor corn crop of that census year[2] and to the disordered conditions

[1] The following table, except the item of "all cereals," is compiled from bulletin No. 24, of the Division of Statistics, U. S. Department of Agriculture, on "Relations of Population and Food Products in the United States," and shows the per capita production of certain food products, as reported to the Census Office during the period from 1850 to 1900:

	1900	*1890*	*1880*	*1870*	*1860*	*1850*
Barley, bu.	1.57	1.25	.88	.77	.50	.22
Buckwheat, bu.	.15	.19	.24	.25	.56	.39
Corn, bu.	34.94	33.89	34.98	19.73	26.68	25.53
Oats, bu.	12.40	12.92	8.13	7.32	5.49	6.32
Rye, bu.	.34	.45	.39	.44	.67	.61
Wheat, bu.	8.66	7.48	9.16	7.46	5.51	4.33
Rice, lbs.	3.29	2.05	2.19	1.91	5.95	9.28
Potatoes, bu.	3.60	3.47	3.38	3.72	3.53	2.84
Sweet potatoes, bu.	.56	.70	.67	.56	1.34	1.65
Sugar, lbs.	6.54	5.34	5.09	3.45	10.09	14.29
Syrup and molasses, gal.	.58	.83	.93	.61	.74	.55
Pulse, bu.	.19	.15	.19	.15	.47	.40
Cattle, no.	.69[3]	.82	.72	.62	.81	.77
Swine, no.	.83	.92	.95	.65	1.07	1.31
Sheep, no.	.52	.57	.70	.74	.71	.94
All cereals, bu.	58.7	56.2	53.8	36.0	39.5	37.5

[2] Average yield per acre of cereal crops as estimated by the Department of Agriculture for the census years 1870, 1880, 1890 and 1900. (Bushels.)

Year.	*Corn.*	*Wheat.*	*Oats.*	*Barley.*	*Rye.*	*Buckwheat.*
1899	25.3	12.3	30.2	25.5	14.4	16.6
1889	27.0	12.9	27.4	24.3	13.1	14.5
1879	29.2	13.8	28.7	24.0	14.5	20.5
1869	23.6	13.6	30.5	27.9	13.6	16.9

Department of Agriculture, Year Book (1899), pp. 759–763.

[3] Cattle over one year.

then existing in the Southern States. Some allowance should, doubtless, be made also, in the table as a whole, for changes in the proportion of the several cereal products to the total cereal product.

In the matter of the corn crop reported upon by the census of 1870, it is interesting to note how differently the figures would appear had the yield for that year been a normal one. The average yield of corn, for that year, as estimated by the Department of Agriculture, was 23.6 bushels; but the average for the previous year was 26.0 bushels and that for the succeeding year was 28.3 bushels.[1] The medium between the averages for the next preceding and next succeeding years is 27.1 bushels. With an average yield per acre of corn equal to this medium number the cereal product for the census year 1870 would have been increased by 131,177,939 bushels and the index number representing the cereal production of that year, instead of being 224.9 would have been 246.2. If this latter number be substituted in the column of index numbers for cereal production, there will appear an unbroken increase in the proportion of cereal products to population, during the whole of the period under consideration.[2]

CONCERNING THE INCREASE IN CULTIVATED AREA PER FARM WORKER AND THE GREATER EFFECTIVENESS OF FARM WORKERS WHEN AIDED BY THE USE OF MACHINERY, AS SHOWN BY REPORTS OF THE CENSUS OFFICE

The census office statistician for agriculture presents a table as follows:[3]

[1] Department of Agriculture, Year Book (1899), p. 759.

[2] See the right hand column of figures in the table of index numbers, p. 13.

[3] Twelfth Census, Agriculture, I, p. xxxi.

Items.	*1900.*	*1890.*	*1880.*
Number of males in agriculture .	8,771,181	7,787,539	7,075,983
Number of horses, mules and asses	20,099,826	17,264,999	12,170,296
Acres of land in specified crops .	272,304,111	214,523,412	164,830,442
Average number of acres to one male worker	31.0	27.5	23.3
Average number of acres to one horse	13.5	12.4	13.5
Average number of horses to one male worker	2.3	2.2	1.7

Farther on, speaking with reference to this table, he says: "The number of acres of leading crops per male worker steadily increased, while the number per working animal was substantially the same in 1900 as in 1880. The increase in the productiveness of man's labor, therefore, is secured by the increased utilization of the power of the horse and mule in driving farm machinery. The figures of the table indicate two important changes in the twenty years. One of these appears in the increase in the number of horses to each male worker from 1.7 to 2.3, a gain of about 35 per cent; the other is the increase in the number of acres cultivated to each male worker from 23.3 to 31.0, or about 34 per cent. From these figures it appears that in the last twenty years, by the aid of machinery, and the substitution of horse power for hand labor, the effectiveness of human labor on farms has been increased to the extent of about 33 per cent."

The statement that there has been an 'increase in the number of horses and of acres cultivated, to each male worker' is mathematically correct enough but it gives the impression that the *farmers have both increased in numbers at the same rate as people engaged in other occupations and have expanded their holdings*, which is not at all true. It will be noted that the num-

ber of horses per acre of cultivated land was the same in 1900 as in 1880. Horses and crop acreage have, therefore, increased at an equal rate. Either these have increased at an extraordinary rate or the third term (male workers), has increased at less than the normal rate. It will be shown farther on (pp. 36–38) that this latter hypothesis is the true one. The increased crop acreage per worker is, therefore, to be looked upon not so much as an expansion of farm holdings as a contraction in the number of workers.

The average number of acres[1] in all farm crops per farm worker[2] (agricultural laborers, farmers, planters, and overseers)—male and female—as returned by the Censuses of 1880, 1890, and 1900 was as follows:

	1900.	*1890.*	*1880.*
United States[3]	27.0	25.9	21.8
North Atlantic division	21.3	21.2	21.7
South Atlantic division	13.3	14.2	13.8
North Central division	45.2	40.4	31.9
South Central division	16.5	15.9	14.2
Western division	39.6	33.7	34.2

Presented from the basis of a common denominator, the data shown in the foregoing table appear as follows:

	Base.	*1880.*	*1890.*	*1900.*
United States	21.8 =	100	118.7	123.8
North Atlantic division .	21.7 =	100	97.7	98.0
South Atlantic division .	13.8 =	100	102.9	98.6
North Central division .	31.9 =	100	126.6	141.7
South Central division .	14.2 =	100	111.9	116.7
Western division . . .	34.2 =	100	98.5	115.8

Such calculations are good as indicating the greater crop area which the average person finds it profitable to

[1] For data of acreage see p. 102.

[2] For total number of workers see p. 99.

[3] In the various tables presented in this essay the term "United States" is used to signify only the five principal geographical divisions taken collectively. Data from the Census Reports have been modified, when necessary, to make them conform to such restricted meaning.

tend when aided by machine power. One needs to be on guard, however, against taking them as indexes of the greater effectiveness of man-labor, due to the use of machinery; for obviously, they take no account of the character of the cultivation—whether intensive or extensive. Construed as indexes of effectiveness, these figures show that the effectiveness of the average worker in the North Central, South Central, and Western Divisions has been much increased during the period from 1880 to 1900 while that of the average worker in the North Atlantic and South Atlantic divisions has actually become less. Such a conclusion would be clearly wrong. There is good reason for believing that the effectiveness of the average farm worker in each of these divisions,[1] and even in the New England States alone[2] was, in all likelihood, very much greater in 1900 than in 1880.

If we take the value of product per person engaged in agriculture as an index of effectiveness under the methods in use in 1880 and in 1900 we shall find that the effectiveness of the average worker in the United States was greater, by nearly 60 per cent.,[3] in 1900 than in 1880.

The census of 1870 did not report crop acreage at all, and the value of agricnltural products was reported in connection with the value of betterments, so that no showing of the relative effectiveness of agricultural workers, in 1870 and in 1900, based either on crop acreage or on value of products, can be made; but, judged by the quantity of cereal product reported, per

[1] See p. 69-70.

[2] See p. 31.

[3] 58.4 per cent. For value of product per person engaged in agriculture in 1880 and 1900 see table at p. 70.

person engaged in farm work (*i. e.*, farmers, planters, overseers, and agricultural laborers), the effectiveness of the average farm worker in 1900 was greater than in 1870 by nearly 86 per cent.[1] The data at hand do not appear to admit of any similar showing as between the year 1900 and any date prior to 1870.

THE GREATER EFFECTIVENESS OF FARM WORKERS WHEN AIDED BY THE USE OF MACHINERY, AS SHOWN BY INVESTIGATIONS OF THE DEPARTMENT OF LABOR

The Thirteenth Annual Report of the Department of Labor gives the results of an extended investigation concerning production by hand and by machine methods, and affords the means for a reliable estimate of the influence of machine power. That portion devoted to agricultural operations shows in detail, for example, how many persons were ordinarily required for the production, by hand or by machine methods, of a given quantity of barley; what separate operations were necessary in that production, as plowing, sowing, harrowing, etc.; what time was required for each operation, what tools or machines, if any, or other helps were used, and the money cost of each operation.

From the summary given on pages 24–25 of that report it appears that the man-labor power requisite for the production of thirty bushels of barley by the methods commonly in use in the season of 1829–30, amounted to 63 hours and 35 minutes. The man-labor power required for accomplishing the same result, by the methods commonly in use in the season of 1895–96, is shown to have been only 2 hours and 42.8 minutes. From such data, the barley crop of 1896 being known,

[1] 85.8 per cent. The cereal product per worker, as above, in 1870, was 236.5 bushels; in 1900 it was 439.6 bushels.

we may readily determine not only what amount of man-labor was requisite for the production of that crop by the means commonly in use at that time, but also how much barley that same labor-power could have produced by the means commonly in use in the season of 1829–30. The difference between the quantity actually produced in the season of 1895–96, and the quantity which the labor-power required for the work of that season, could have produced by the earlier hand methods, will represent the greater product due to the use of machinery. The crediting of the whole of this difference to the use of machinery is, doubtless, crediting it with too much. Credit is due, also, to better methods of cultivation, to pulverization of soils, to the use of fertilizers, to irrigation, rotation of crops, better seed, etc. These are not machine forces although they are largely dependent upon the use of machinery as the use of machinery is, in some degree, dependent upon them. But to attempt the separation of these credits would be much like attempting to determine which blade of a pair of shears does the cutting. Moreover, these various other forces play, comparatively, a very incidental and subsidiary part. I believe that the following pages will justify this opinion and venture, therefore, to disregard whatever inaccuracy there may be involved in the statement and to say that the entire increased product is due to the use of machinery.[1]

It will be sufficient, for purposes of illustration, to consider only a few of the principal crops in the pro-

[1] For the purpose of this discussion I shall use the term machinery, generally, to signify not only machines, but also tools or implements, and other man-labor saving forces when used as essential adjuncts or parts of machines. For example, horses, when used to draw a reaping machine, will be considered as much a part of the machine as an engine and boiler would be, if used for the same purpose.

duction of which machinery has become a recognized factor. The crops selected for this purpose, together with the time of man-labor requisite for produciug stated quantities of each crop by hand and by machine methods, as reported by the Department of Labor, are shown in the following table :—

Unit No.[1]	Name and quantity of crop produced and description of work done.	Year of Production		Time Worked			
				Hand		Machine	
		Hand	Machine	hrs.	min.	hrs.	min.
3	Barley : 30 bushels (1 acre) barley	1829-30	1895-96	63	35.0	2	42.8
9	Corn : 40 bushels (1 acre) yellow corn, husked ; stalks left in field	1855	1894	38	45.0	15	7.8
10	Cotton : By hand, 750 pounds ; by machine 1000 pounds(1 acre) seed cotton.	1841	1895	167	48.0	78	42.0
12	Hay : Harvesting 1 ton (1 acre) timothy hay	1850	1895	21	5.0	3	56.5
13	Oats : 40 bushels (1 acre) oats	1830	1893	66	15.0	7	5.8
16	Potatoes : 220 bushels (1 acre) potatoes . .	1866	1895	108	55.0	38	. .
17	Rice : 2640 pounds (1 acre) rough rice . .	1870	1895	62	5.0	17	2.5
18	Rye : 25 bushels (1 acre) rye	1847-48	1894-95	62	58.9	25	10.0
26	Wheat : 20 bushels (1 acre) wheat	1829-30	1895-96	61	5.0	3	19.2

These several crops for the years covered by the data concerning production by the aid of machine power, were as follows :[2]

[1] The "unit numbers" here given are the unit numbers made use of in the Thirteenth Annual Report of the Department of Labor, from which the data in the table are taken. The numbers are repeated here only for purposes of reference.

[2] Department of Agriculture, Year Book for 1900.

Barley, crop of 1896 (bushels) 69,695,223
Corn, " " 1894 (bushels) 1,212,770,052
Cotton, " " 1895 (500 lb. bales) 7,161,094
Hay, " " 1895 (tons) 47,078,541
Oats, " " 1893 (bushels) 638,854,850
Potatoes, " " 1895 (bushels) 297,237,370
Rice, " " 1896 (pounds) 168,685,440
Rye, " " 1895 (bushels) 27,210,070
Wheat " " 1896 (bushels) 427,684,346

The number of days-work of man-labor requisite for producing the foregoing specified crops by the aid of machine power, together with the quantity of those several crops which the same labor-power could have produced by the earlier hand method, are shown in the following:

Name	Crop of	Days-work of man-labor required	The same labor power		
			by methods of	could have produced	
Barley .	1896	630,354	1829-30	(bushels)	2,972,839
Corn . .	1894	45,873,027	1855	(bushels)	473,528,022
Cotton .	1895	28,178,904	1841	(bales)	2,518,972
Hay . .	1895	18,556,791	1850	(tons)	8,801,640
Oats . .	1893	11,334,266	1830	(bushels)	68,433,307
Potatoes	1895	5,134,100	1866	(bushels)	103,703,321
Rice . .	1895	108,889	1870	(pounds)	46,303,587
Rye . .	1895	2,739,147	1847-48	(bushels)	10,872,795
Wheat .	1896	7,099,560	1829-30	(bushels)	23,245,490

Finding next the difference between the quantities of the several crops actually produced under machine methods, in the years indicated, and the quantities which the labor-power requisite for their production with the aid of machines could have produced had it been devoted to the production of those same crops by hand methods, we have the following:

	Crop of	*Due to use of machinery.*		*% of actual product.*
Barley	1896	(bushels) 66,722,384	=	95.7
Corn	1894	(bushels) 739,242,030	=	60.9
Cotton	1895	(bales) 4,642,122	=	64.8
Hay	1895	(tons) 38,276,901	=	81.3
Oats	1893	(bushels) 570,421,543	=	89.2
Potatoes	1895	(bushels) 193,534,049	=	65.1
Rice	1895	(pounds) 122,381,853	=	72.5
Rye	1895	(bushels) 16,337,275	=	60.0
Wheat	1896	(bushels) 404,438,856	=	94.5

The increased effectiveness of man labor power when aided by the use of machinery, as indicated by these figures, varies from 150 per cent in the case of rye to 2244 per cent in the case of barley. From this point of view a machine is "not a labor-saving" but rather a "product-making" device.[1] Taking the per cent of labor saved (See page 29), as indicating the average proportion of these crops due to the use of machinery, it appears that the quantity of product is almost five times as great, per unit of labor, as it formerly was.

THE COST OF PRODUCTION

Touching the difference in the cost of production per unit of product the Thirteenth Annual Report of the Department of Labor furnishes some data that will well repay a somewhat extended consideration. It should be observed, however, that these data with reference to the cost of production, although collected at the same time and, doubtless, with the same care, as the data already taken from that report, are, nevertheless, for the purposes of generalization, far less reliable. The average workman will perform the same quantity of work in a day, whether he works in one locality or in another; but rates of wages vary with localities and may vary both absolutely and relatively with differences in time. With this qualification in mind, it will be safe to take up the consideration of the data.

[1] Hadley; Economics, page 338.

Including the crops above considered, the report of the Department of Labor, gives detailed information concerning the cost of production, by hand and by machine methods, of twenty-one different crops. The table on the next page gives the results of the several investigations in this particular, arranged in the order of the greatest saving in cost of production by machine as compared with hand methods.[1]

The per cent column of the following table shows that, for the most part, there has been a very great decrease in the cost of producing these various crops. The median is 39.92 per cent, but this number is clearly too low, for the crops in which machinery is most used are principally in the upper part of the table.

[1] In the production of peas and in both tobacco crops there has been an increase in the cost. This increase is not, however, from the use of machinery in the production of these crops, but rather from the lack of it. In the case of tobacco (unit 22), for example, in which there has been the greatest increase in cost, the hand method production was with the aid of the following: wagon, spades, hoes, rakes, wooden moldboard plows, harrow, turn plow, wooden pegs for setting plants, plow for cultivating, and tobacco knives. The total extent of the machinery used in the production of this crop by machine methods was as follows: plow, harrow, rakes, hoes, disk harrow, drag, wagon and barrels, transplanter, double-shovel plow, tobacco knives, wagon and racks, and screw racket prize. (Thirteenth Annual Report, Department of Labor, page 464.)—It must be evident at once from a comparison of these items that the difference in machinery cannot account for the difference in cost of production. The cause of the increased cost in the production of tobacco and peas (units 15, 22, and 23) was a higher rate of wages. In the case of peas, wages rose from 62½ cents to $1.00 per day. In the case of tobacco (unit 22), wages rose from 30 cents per day to $20 and $23 per month; in unit 23, the rise of wages was from 75 cents to $1.00 per day. It will be readily understood that when there is little or no change in the methods of production a rise in the rate of wages must cause a rise in the total cost of production.

The "hand method" of production, as explained in the report of the department, "should not be construed to mean a method whereby a product is made entirely by the unaided hand and absolutely without the use of machines, but rather as the primitive method of production which was in vogue before the general use of automatic or power machines."—(Thirteenth Annual Report, Department of Labor, p. 11.)—Similarly, it should be observed, in this connection, that "machine method" does not necessarily imply that machines are used, but only that the work was done by the most approved methods practiced in more recent years.

For a table of wages under hand and machine methods, see p. 60.

Unit No.[1]	Name and Quantity of Crop Produced.	Year of Product'n		Cost.		Per cent Decrease
		Hand Method.	Machine Method.	Hand Method.	Machine Method.	
3	Barley; 30 bu. (1 acre)	1829–30	1895–96	$ 3.88	$ 1.06	72.62
27	Wheat: 20 bu. (1 acre)	1829–30	1895–96	4.00	1.12	71.98
5	Broom corn: 1 ton (3 acres)	1860	1895	90.33	25.37	71.92
17	Rice: 2640 lbs. (1 acre)	1870	1895	7.20	2.08	71.09
21	Sweet Potatoes: 105 bushels (1 acre)	1868	1895	34.30	10.29	70.00
12	Hay: Harvesting 1 ton (1 acre) timothy hay	1850	1895	1.92	.63	66.95
8	Corn: 40 bushels (1 acre) yellow corn, shelled; stalks, husks and blades cut into fodder	1855	1894	16.34	6.62	59.49
20	Sugar corn: 20 tons (1 acre)	1855	1895	40.32	16.37	59.40
13	Oats: 40 bushels (1 acre)	1830	1893	3.85	1.60	58.47
19	Strawberries: 4,000 qts. (1 acre)	1871–72	1894–95	231.28	97.92	57.66
24	Tomatoes: 150 bu. (1 acre)	1870	1895	36.62	15.88	56.64
16	Potatoes: 220 bu. (1 acre)	1866	1895	13.18	5.97	54.68
26	Wheat: 20 bu. (1 acre)	1829–30	1895-96	3.83	2.03	47.11
11	Hay: Harvesting and baling 1 ton (1 acre) timothy hay	1860	1894	3.19	1.91	39.92
2	Apple trees: 10,000 (1 acre) 32 months, from grafts	1870–72	1893–95	200.00	121.00	39.50
4	Beets: 300 bushel (1 acre	1850	1895	32.30	20.01	38.05
9	Corn: 40 bushels (1 acre) yellow corn, husked; stalks left in field	1855	1894	5.03	3.31	34.20
7	Carrots: 30 tons (1 acre)	1850	1895	38.71	37.21	29.72
14	Onions: 250 bu. (1 acre)	1850	1895	32.56	23.89	26.64
1	Apple trees: 10,000 (1 acre) 32 months, from grafts	1869–71	1893–95	202.00	150.69	25.41
10	Cotton[2]: By hand 750 lbs.; by machine 1000 lbs. (1 acre)	1841	1895	6.15	4.71	23.42
18	Rye: 25 bushels (1 acre)	1847–48	1894–95	5.25	4.30	18.10
25	Turnips: 350 bu. (1 acre)	1855	1895	25.63	23.36	8.88
6	Carrots: 30 tons (1 acre)	1855	1895	30.61	29.96	2.13
						Per cent. Increase
15	Peas: 20 bushels (1 acre) field Peas	1856	1895	6.66	6.76	1.56
23	Tobacco: 1,500 lbs. (1 acre) Spanish seed leaf	1853	1895	25.85	27.99	8.28
22	Tobacco:[3] By hand, 1,200 lbs.; by machine 1,250 lbs. (1 acre)	1844	1895	.74	2.67	261.42

[1] See footnote "1" page 21.

[2] The data have been modified to show a comparison on the basis of equal quantities produced. If the equal areas be taken instead, the line should read: Cotton: By hand, etc., $9.23; $9.42. 2.09.

[3] The data have been modified to show a comparison on the basis of equal quantities produced. If the equal areas be taken instead, the line should read: Tobacco: By hand, etc., $8.88; $33.39; 276.33.

The data requisite for a similar showing with respect to all farm crops and for any certain period are, I think, not to be had; but we can apply the data presented in the foregoing table to the principal crops of the year 1899, as reported by the Twelfth Census.[1] The results are as follows:—

THE COST OF PRODUCING CERTAIN CROPS OF THE YEAR 1899, BY HAND AND BY MACHINE METHODS.

Name[2]	*Quantity produced*	*Cost of Production*	
		Hand Method	*Machine Meth.*
Barley (3) (bu.)	119,634,877	$ 15,472,777	$ 4,227,098
Broomcorn (5) . . . (lbs.)	90,947,370	4,107,576	1,153,650
Corn (9) (bu.)	2,666,440,279	335,304,865	220,647,933
Cotton (10) (bales)	9,534,707	58,638,448	44,898,469
Hay (12) (tons)	84,011,299	161,301,694	52,927,118
Oats (13) (bu.)	943,389,375	90,801,227	37,735,575
Onions (14) (bu.)	11,791,121	1,535,675	1,126,759
Peas (15) (bu.)	9,440,269	3,143,609	3,190,810
Potatoes (16) . . . (bu.)	273,328,207	16,373,935	7,417,133
Rice (17) (lbs.)	283,722,627	773,788	223,539
Rye (18) (bu.)	25,568,625	5,369,411	4,397,803
Sugar cane (20) . . (tons)	6,441,578	12,986,221	5,272,431
Sweet potatoes (21) (bu.)	42,526,696	41,676,162	4,167,616
Tobacco (22) (lbs.)	868,163,275	6,424,408	18,491,859
Wheat (26) (bu.)	658,534,252	126,109,309	66,841,226
Total		$880,019,105	$472,719,019

The estimated cost of producing these crops by machine method is only 53.7 per cent of the estimated cost of producing the same crops by hand method. In other words, the saving in cost of production amounts to 46.3 per cent. The average date of the hand method investigations made use of in this presentation is 1850; the average date for the machine method investigations

[1] Twelfth Census: Agriculture I, p. cxxi.

[2] The figures in parentheses are the unit numbers used by the Department of Labor and indicate what set of reports was used as the basis of the estimated cost of production as here presented. The dates of the investigations for hand and for machine methods may be found by reference to the preceding table.

is 1895—a difference of forty-five years. Surely it will not be too much to say that during the last half of the nineteenth century the cost of production of these crops was reduced by one-half. If we take into account the decreased cost to the farmer of food and lodging for his hired workmen and of the decreased cost of storage room for grain in the straw, then the total saving must appear to be even greater than this.[1]

FLUCTUATIONS IN QUANTITY OF PRODUCT

The use of machinery in the production of agricultural products, as in the production of manufactures, tends to diminish the fluctuations in supply. Capital in any form, cannot, ordinarily, be diverted from the production for which it was designed, without more or less waste. If, for example, a farmer wishes to change from producing wheat to producing potatoes, he must sell his reaper at a sacrifice. The difficulty in making such changes operates against great and sudden changes from

[1] "To ascertain the amount of saving precisely is difficult; but looking through the successive stages of management and seeing that the owner of a stock farm in the preparation of his land by using lighter ploughs is able to cast off one horse in three; and by adopting other simple tools to dispense altogether with the great part of his ploughing; that in the culture of crops by the various drills, horsepower can be partly reduced; the seed otherwise wanted, partly saved; and the use of manures greatly economized; while the horse hoe replaces the hoe at one-half the expense; that at harvest the American reaper can effect nearly thirty men's work; while the Scotch cart replaces the old English wagon with exactly half the horses; that in preparing corn for food the steam threshing machine saves two thirds of our former expense; and in preparing food for stock the turnip-cutter, at an outlay of 1s., adds 8s. a head in one winter to the value of sheep; lastly, that in the indispensable but costly operation of drainage, the materials have been reduced from 80 s. to 15 s., to one fifth namely of their former cost; it seems to be proved that the efforts of agricultural mechanists have been so far successful, as in all these main branches of farming labour taken together, to effect a saving on outgoings or else an increase of incomings of not less than one-half."—Quoted from Pusey's report on Agricultural Implements in the Exhibit of 1851, by Hearn, "Plutology," page 171.

one line of production to another, even when the prospects for profit in such other line may be unusually bright. Thus the supply of the more profitable product is restricted. On the other hand, farmers having their capital in the form of machinery devoted to the production of some particular crop, will continue to produce somewhat of that crop rather than to have their capital lie idle or to suffer a greater loss from an attempt to change. This influence operates towards maintaining the former supply.

As a consequence of these two dissimilar forces, the supply of any product is more constant, and the resulting fluctuations in price less violent than they otherwise would be.

THE QUALITY OF AGRICULTURAL PRODUCTS

The use of machinery is not without some influence on the quality of the product. Corn, which, by reason of too early or too late planting, as was necessarily frequent under hand methods of production, does not mature properly, and is unwholesome; and grain cut, as formerly, under hand methods, before it is thoroughly ripened, becomes shrunken and of less value.

In the matter of preparing grain for use the advantages of machinery are equally evident. The present generation of Americans would be slow to eat bread made of flour from wheat threshed by the treading of horses or cattle.

PART III

MACHINERY AND LABOR

SAVING OF LABOR

The quantity of labor which, by the use of machine power, is saved for other uses, may be determined, in the case of any particular crop, by finding the difference between the number of days-work requisite for producing it by hand and by machine methods. In the following table there is shown the quantity of man-labor requisite for producing the nine principal farm crops by hand and by machine methods; the quantity of labor saved in each case by the use of machinery; and the per cent which the quantity of saved labor is of the quantity requisite for producing the several crops by hand method.

DAYS-WORK NECESSARY TO PRODUCE

BY HAND METHODS

	Crop of	*Methods of*	*Days-work*
Barley	1896	1829–30	14,771,515
Corn	1894	1855	117,487,098
Cotton	1895	1841	80,108,771
Hay	1895	1850	99,257,257
Oats	1893	1830	105,810,334
Potato	1895	1866	14,715,501
Rice	1896	1870	396,687
Rye	1895	1847–48	6,854,942
Wheat	1896	1829–30	130,621,927
Total			570,024,032

BY MACHINE METHODS

	Crop of	*Methods of*	*Days-work*	*Days-work saved by machinery*	*Per cent*
Barley	1896	1895–96	630,354	14,141,161	= 95.7
Corn	1894	1894	45,873,027	71,614,071	= 60.9
Cotton	1895	1895	28,178,904	51,929,867	= 64.8
Hay	1895	1895	18,556,791	80,700,466	= 81.3
Oats	1893	1893	11,334,266	94,476,068	= 89.2
Potato	1895	1895	5,134,100	9,581,401	= 65.1
Rice	1896	1896	108,889	287,796	= 72.5
Rye	1895	1894–95	2,739,147	4,115,795	= 60.0
Wheat	1896	1895–96	7,099,560	123,522,367	= 94.5
Totals			119,655,038	450,368,992	= 79.0

The total amount of man-labor-power saved by the use of machinery in the production of these nine crops was 450,368,992 days-work or 79.0 per cent of the amount of work which would have been required to produce those same crops by the earlier hand methods. In other words, the quantity of labor now requisite for the production of a given quantity of these nine crops is, on the average, only 21 per cent, or a little over one-fifth of the quantity which would be requisite under the former hand methods of production.[1]

DISPLACEMENT OF LABOR

The question of the displacement of labor is one of peculiar interest to those who work for hire, because upon it seems to depend the further question of whether the use of machinery decreases the opportunities for earning a livelihood. That the introduction of machinery does frequently deprive workmen of employment in particular lines of work is undeniably true. The introduction of a harvesting machine throws cradlers and binders out of employment just as certainly as the introduction of water drives air out of a jug. It is idle to say that machinery does not displace individual workmen and equally idle to contend that such displacement does not entail hardship and suffering, for the more thoroughly and completely one devotes himself to any particular line of work, the less fitted does he become for taking up, and gaining a livelihood in, some other occupation. The extent of change which the introduction of machinery produces in the occupation of individuals is much obscured by the fact that the machine workman is usually given

[1] See also Edward Atkinson's "Distribution of Products", pages 14–15 and 287.

the same name as was borne by his predecessor; as, for example, men who operate a steam threshing machine are called threshers, though they may never have seen a flail and are almost as little fitted for operating a flail and winnowing apparatus as the old time threshers would be to operate the new machine. The *old* occupation is gone. What we now have is a *new* occupation passing under the old name. And a new class of workmen (machinists,) are in charge.

It is only when we speak of labor as a quantity or of laborers in mass that we can presume to say there has been no displacement of labor by machinery; and yet there may be, in this sense also, a displacement of labor. The displacement may be absolute, as where the labor force in any line of work is decreased, or it may be only relative, as where the rate of increase in the number of laborers employed falls below the rate of increase of laborers employed in industries generally.

THE ABSOLUTE DISPLACEMENT

For the agricultural industry considered as a whole, New England furnishes an instance of the absolute displacement of labor. In 1880, the population, ten years of age and over, engaged in agriculture, numbered 304,679; but in 1900, the number was only 287,829.[1] This decrease was not due to a decadence of agriculture in those states, for the value of the New England agricultural products was more than fifty per cent greater in 1900 than in 1880.[2] It must have been due to the introduction of machinery as indicated

[1] See page 101.

[2] The value of New England agricultural product, as reported in 1880, was $103,343,566; in 1900 it was $169,523,435. Twelfth Census: Agriculture I, page 703.

by the reported valuation of agricultural implements and machines, which increased from $1.68 per acre of improved land in 1880, to $4.49 per acre in 1900.[1]

With respect to the work of cultivating and caring for those nine crops in the production of which machinery appears to be most extensively used, we may determine what absolute displacement, if any, has taken place by finding in each case what amount of labor was necessarily employed in the time of production by hand methods and comparing that amount with the amount of labor necessarily employed in the time of production by machine methods. Data of crop production for the exact years covered by the report of the Department of Labor concerning production by hand method cannot be secured for all of the crops, but taking the best available data and tabulating results we have the following:

DAYS-WORK OF MAN-LABOR REQUIRED FOR PRODUCING THE

	Crop of[2]	*By methods of*	*Days-work*
Barley	1839	1829–30	882,007
Corn	1855	1855	74,151,217
Cotton	1841	1841	13,717,188
Hay	1849	1850	29,176,470
Oats	1839	1830	20,381,312
Potato	1866	1866	5,307,260
Rice	1871	1870–71	124,383
Rye	1849	1847–48	3,574,396
Wheat	1839	1829–30	25,905,766
Total			173,219,999

[1] Twelfth Census: Agriculture I, page 698.

[2] The barley crop of 1839 was 4,161,504 bushels—Sixth Census, page 408.

The corn crop of 1855 is assumed to be 765,431,923 bushels. This is midway between the amounts reported to the census office in 1850 and 1860.

The cotton crop of 1841 was 1,634,945 bales.—World Almanac for 1896, page 164.

The hay crop of 1849 was 13,838,642 tons.—Eleventh Census: Agriculture, page 90.

	Crop of	*By methods of*	*Days-work*	*Difference in days-work*	*Displacement per cent*
Barley	1896	1895–96	630,354	251,653	28.5
Corn	1894	1894	45,873,027	28,278,190	38.1
Cotton	1895	1895	28,178,904		
Hay	1895	1895	18,556,791	10,619,679	36.4
Oats	1893	1893	11,334,266	9,047,046	44.4
Potato	1895	1895	5,134,100	76,536	3.3
Rice	1896	1895–96	108,889	15,494	12.5
Rye	1895	1894–95	2,739,147	835,249	23.4
Wheat	1896	1895–96	7,099,560	18,806,206	72.6
Total			119,655,038	67,930,053	42.5

The table shows that in the work of producing each of the crops considered, excepting only the cotton crop, there has been an absolute displacement of man labor. Disregarding the cotton crop, the absolute displacement in the work of producing the other eight crops is 42.5 per cent. If cotton be included in the summary and allowance be made for the additional labor employed in the production of that crop, the absolute displacement becomes 30.9 per cent.

The oats crop of 1839 was 123,054,992.—Report of the Department of Agriculture for 1862, page 572.

The potato crop of 1866 was 107,200,976 bushels.—Year Book of Department of Agriculture, 1898, page 679.

The rice crop of 1870–71 was 52,892,400 pounds.—Letter of August 26, 1902 from Department of Agriculture, Division of Statistics.

The rye crop of 1849 was 14,188,813 bushels.—Patent Office Report, 1853, Part 2, page 155.

The wheat crop of 1839 was 84,821,065 bushels.—Report of Department of Agriculture, 1862, page 572.

Crop reports for the desired years could not be found in every case. When the difference between the year reported upon by the investigations of the Department of Labor and the nearest year for which a crop report could be had was greater than one year a later crop report was preferred as yielding a displacement of labor too low rather than too high.

THE RELATIVE DISPLACEMENT

The relative increase or decrease of the population engaged in agriculture as compared with the increase or decrease of the population engaged in each of the other occupation classes, for the continental portion of the United States, and for the several geographical divisions, during the period from 1880 to 1900, is shown in the followiug tables:[1]

UNITED STATES

Males and females ten years of age and over	*Base* 1880	*1890*	*1900*
Total population	36,761,607=100	129.0	157.6
In gainful occupations	17,392,099=100	130.7	167.2
In agriculture	7,713,875=100	111.0	135.9
In professional services	603,202=100	156.6	208.7
In dom. and per. services	3,423,815=100	123.3	163.0
In trade and transp.	1,866,481=100	178.2	255.4
In manfg. and mech. arts	3,784,726=100	150.0	187.2
NORTH ATLANTIC DIVISION			
Total population	11,270,090=100	123.2	148.1
In gainful occupations	5,309,722=100	131.3	161.6
In agriculture	1,048,442=100	104.9	102.5
In professional services	207,551=100	144.3	198.2
In dom. and per. services	1,211,958=100	121.1	153.2
In trade and transp.	828,802=100	158.9	225.4
In manfg. and mech. arts	2,012,969=100	138.1	167.4
SOUTH ATLANTIC DIVISION			
Total population	5,286,645=100	121.4	144.1
In gainful occupations	2,677,762=100	116.4	149.4
In agriculture	1,622,081=100	102.9	125.3
In professional services	62,309=100	148.2	191.6
In dom. and per. services	517,429=100	112.3	154.4
In trade and transp.	177,436=100	174.0	238.0
In manfg. and mech. arts	298,507=100	156.4	210.3
NORTH CENTRAL DIVISION			
Total population	12,760,841=100	132.5	158.9
In gainful occupations	5,625,123=100	136.4	170.3
In agriculture	2,735,525=100	113.9	128.3
In professional services	230,622=100	161.0	207.4
In dom. and per. services	1,025,089=100	129.6	171.7
In trade and transp.	595,791=100	193.2	280.5
In manfg. and mech. arts	1,038,096=100	164.3	208.4

[1] For absolute numbers, see page 93.

SOUTH CENTRAL DIVISION

Males and females ten years of age and over	*Base 1880*	*1890*	*1900*
Total population	6,076,243=100	128.4	166.6
In gainful occupations	3,022,173=100	120.3	172.4
In agriculture	2,120,525=100	109.5	155.7
In professional services	73,455=100	155.6	207.4
In dom. and per. services	464,909=100	112.7	170.7
In trade and transp.	161,449=100	195.3	294.8
In manfg. and mech. arts	201,835=100	178.5	241.3

WESTERN DIVISION

Total population	1,367,788=100	175.5	236.5
In gainful occupations	757,319=100	176.5	224.9
In agriculture	187,302=100	191.5	248.3
In professional services	29,265=100	228.6	333.1
In dom. and per. services	204,430=100	156.1	181.6
In trade and transp.	103,003=100	227.3	320.3
In manfg. and mech. arts	233,319=100	153.3	188.4

In the United States as a whole, and in each division, excepting only the Western division, the rate of increase in the agricultural population has been much lower than in any other one of the occupation classes. Not only this, but, subject to the same exception, it has been lower than either the rate of increase in the total population or in the number of those engaged in gainful occupations. We must conclude, therefore, that for the period from 1880 to 1900, as compared with the growth in the number of those engaged in other industries, there has been a decrease in the number of those engaged in agriculture.[1]

[1] Bringing together the data concerning the population engaged in agriculture, as presented in the foregoing tables, so as to show the relative rate of increase in that class in the different sections of the country, we have the following:

POPULATION ENGAGED IN AGRICULTURE—(MALES AND FEMALES)

	Base 1880	*1890*	*1900*
United States	7,713,875=100	111.04	135.88
North Atlantic division	1,048,442=100	104.86	102.47
South Atlantic division	1,622,081=100	102.89	125.30
North Central division	2,735,525=100	113.94	128.26
South Central division	2,120,525=100	109.48	155.66
Western division	187,302=100	191.51	248.34

The rate of increase of males and females in the various occupation classes has been very different. The relative rates of increase, in the agricultural industry, as reported for the several sections of the country, are shown in the following table:

POPULATION ENGAGED IN AGRICULTURE[1]

	Base	*1880*	*1890*	*1900*
United States, males	7,119,365=100		110.78	132.09
females	594,510=100		114.19	164.39
North Atlantic div., males	1,043,497=100		103.38	99.64
females	4,945=100		418.07	701.37
South Atlantic div., males	1,358,072=100		104.68	125.00
females	264,009=100		93.67	126.86
North Central div., males	2,720,123=100		111.64	125.31
females	15,402=100		520.47	649.38
South Central div., males	1,811,486=100		110.28	155.03
females	309,039=100		104.80	159.30
Western div., males	186,187=100		188.98	241.57
females	1,115=100		613.36	1379.55

The foregoing table shows that women, much more rapidly than men, are turning to agricultural pursuits. The introduction and use of machine power, by decreasing the requirements of physical strength has placed men and women upon a more equal footing and women promise now to invade the agricultural industry as they have heretofore invaded that of manufactures.

We may ascertain the extent of the movement to or from any occupation class during any period by comparing the distribution of the people among the various occupation classes at the beginning of such period with their distribution at its close.

The following table shows, for the United States and for the several geographical divisions, what per cent of the total number of those engaged in gainful occupations in 1870 and in 1900 were in the several occupation classes.[2]

[1] See pp. 94–95.

[2] See p. 96.

		Agri-cul-ture	*Prof. ser-vice*	*Dom. & Pers. service*	*Trade and Transp.*	*Mfg. & Mech. Arts*
United States	1900	35.7	4.3	19.2	16.4	24.4
	1870	47.6	3.0	18.2	9.8	21.4
North Atlantic div.	1900	12.5	4.8	21.6	21.8	39.3
	1870	24.9	3.4	21.4	14.2	36.1
South Atlantic div.	1900	50.8	3.0	20.0	10.5	15.7
	1870	63.8	2.0	17.5	5.9	10.8
North Central div.	1900	36.6	5.0	18.4	17.4	22.6
	1870	52.5	3.4	16.7	9.3	18.1
South Central div.	1900	63.4	2.9	15.2	9.1	9.4
	1870	71.5	2.2	14.0	5.3	7.0
Western div.	1900	27.3	5.7	21.8	19.4	25.8
	1870	27.2	3.1	25.4	12.4	31.9

Finding the difference between these several pairs of per cents, and representing increases by positive numbers and decreases by negative numbers, we get the per cent of those engaged in gainful occupations who have shifted to or from the several occupation classes, during the period from 1870 to 1900, as follows:

	Agri-cul-ture	*Prof. ser-vices*	*Dom. & personal services*	*Trade and Transp.*	*Mfg. & mech. arts*
United States	−11.9[1]	1.3	1.0	6.6	3.0
North Atlantic div.	−12.4	1.4	0.2	7.6	3.2
South Atlantic div.	−13.0	1.0	2.5	4.6	4.9
North Central div.	−15.9	1.6	1.7	8.1	4.5
South Central div.	− 8.1	0.7	1.2	3.8	2.4
Western div.	0.1	2.6	−3.6	7.0	−6.1

[1] This −11.9 per cent does not mean that there was a decrease, *absolutely*, in the number of those engaged in agriculture, but only *relatively*, and in this sense; that, whereas the number of those engaged in agriculture increased during the period from 1870 to 1900, the increase was so much less than in the other occupation classes that this particular class failed, by a number equal to 11.9 per cent of the total number engaged in gainful occupations in 1900, to maintain its former proportion. A similar remark applies to each one of the other cases where a negative number appears. The decrease in the class of those engaged in manufactures and Mechanic arts, in the Western division is due to the fact that, under the classification used, miners and quarrymen are included in that occupation class. In 1870, these workers constituted a high proportion of the total number engaged in gainful occupations in that division.

Now the total number engaged in gainful occupations in 1900 was 29,074,117,[1] and 11.9 per cent. of 29,074,117 gives 3,459,819 as the number which, under the conditions existing in 1870, should have been found in the agricultural class in 1900 in addition to the number actually found in that occupation class. The number reported as engaged in the agricultural industry, in 1900, was 10,381,765.[2] It appears, therefore, that during the period from 1870 to 1900 the agricultural class lost, relatively, almost one-fourth of its membership. Of this number 1,523,365,[3] nearly one-half of the total for the whole United States, were from the North Central States.

A table constructed similarly to the one given above and showing, separately, the shifting of males and of females among the different occupation classes, during the period from 1870 to 1900, is presented herewith as follows:—[4]

SHIFTING OF THE POPULATION ENGAGED IN THE DIFFERENT OCCUPATION CLASSES: 1870–1900.

	Agriculture	*Prof. services*	*Dom. & Personal services*	*Trade and Transp.*	*Mfg. & Mech. Arts*
United States, males	—12.5	0.9	2.5	6.6	2.5
females	— 3.2	3.1	—13.6	8.3	5.4
North Atlantic div., males	—14.4	1.2	2.3	7.5	3.4
females	1.5	1.2	—15.5	10.9	1.9
South Atlantic div., males	—13.8	0.6	3.6	5.3	4.3
females	— 7.8	2.6	— 4.8	2.9	7.1
North Central div., males	—15.7	1.0	2.9	8.0	3.8
females	5.4	2.6	—30.1	12.3	9.8
South Central div., males	— 9.0	0.2	2.5	4.2	2.1
females	— 3.4	2.9	— 5.7	2.4	3.8
Western div., males	1.4	1.7	— 4.1	7.2	—6.2
females	5.0	6.7	—26.0	12.1	2.2

[1] See p. 42. [2] See p. 93.

[3] The number engaged in gainful occupations in the North Central States in 1900, was 9,580,913. (Twelfth Census, Population II, page cxxviii). The portion of this population which, during the period from 1870 to 1900, has shifted from agriculture to other occupation classes was 15.9 per cent. (See page 37.)

[4] See pp. 97–98.

It has been shown above that, relatively speaking, nearly three and a half million people changed from agriculture to other industries during the thirty year period, 1870 to 1900. So great a displacement will, doubtless, at first seem incredible. There is need to look at the problem from another point of view: The total number of persons (*i.e.*, farmers, planters, overseers, and agricultural laborers) reported in 1870 as engaged in farming operations was 5,948,561.[1] They produced in that census year 1,388,526,403 bushels of cereals.[2] Making allowance for the short corn crop of 1869,[3] we may say that they were able to have produced 1,519,704,342 bushels of cereals—an average of 255.4 bushels per worker. At this same rate, the 10,381,765 persons (*i. e.*, farmers, planters, overseers and agricultural workers) engaged in cereal production in the census year of 1900[4] could have produced 2,651,502,781 bushels of cereals. The amount would, however, have been less than the actual product in 1899[5] by 1,783,195,965 bushels. To have made good this deficiency, on the basis of the efficiency of the average worker in 1869, would have required an additional force of 6,981,973 workers. This is more than double the number of those who went from agriculture into other occupations. We must, therefore, in all fairness, say, since the machine power introduced into the business of farm work during the period from 1869 to 1899 has more than taken the place of those workers who, during that period, removed from agriculture to other occupations, it has been the cause of their removal. That more have not so removed is, of course, due to the

[1] See p. 93.
[2] See p. 13.
[3] See p. 15.
[4] See p. 93.
[5] See p. 13.

fact that the farm work of the present day calls for a great amount of work not demanded by the business of farming as followed in earlier years.

The matter of change in the character of farm work has made it very difficult for any one, from ordinary observation alone, to judge rightly of the effect of machine power on labor. Even so eminent an authority on agricultural conditions as Professor Davenport, of the University of Illinois, has been misled into thinking that the labor power supplanted by machinery is offset by the demand for labor in new lines of farm work. In his testimony before the Industrial Commission he stated: "The introduction of machinery has vastly extended agricultural operations. It has extended the acreage under cultivation, and has increased the amount of labor bestowed upon the land per acre. I do not think it has decreased the number of men or the total employment of man power on the lands of the country."[1]

It is barely possible that Professor Davenport and the members of the Industrial Commission who examined him, had reference to the absolute and not to the relative number of workers. If such was the case then all that can be said is that Professor Davenport and the commissioners were rather solemnly deliberating upon a subject concerning which the successive census reports left no room for doubt.

But, one may ask, What becomes of the workers who are thus thrown out of employment? and, Are there not some compensating advantages? The first of these questions is easily answered for in the extreme case of an individual who suffers absolute displacement the only alternative from idleness is to accept a lower

[1] Report of the Industrial Commission, Vol. X, page 256. See also the testimony of Mr. Ketchum on page 132 of that report.

rate of wages for work in his accustomed employment or to enter as an inexperienced workman, in some other employment at, most likely, a still lower rate of wages. His compensating advantage is an uncertain one and one hard to estimate. Besides, it does not ordinarily accrue until the time of his greatest need is passed.[1] It arises from the decreased market price of the commodity which he formerly helped to produce. If it is a commodity which enters into his own consumption then the lower price which he pays for it, will in a measure, off-set the lower wage which he receives in his new occupation. If it is not a commodity which enters into his own consumption then his compensating advantage must come through the stimulus which the decreased price of this particular commodity gives to other industries in which it is employed as "raw material" or, more properly, as a factor of production. Cheaper "raw material" yielding, of course, a decreased cost of production, higher profits, and a stronger demand for labor.[2]

[1] "It is small consolation to a working man to be assured that in a year's time he will have plenty of work, if in the meantime he must remain breadless. Loss of work even for a few weeks may exhaust his credit and the affection and means of his friends, and there may remain nothing for him but starvation, unless poor-laws or private charity come to the rescue."—Nicholson: Effects of Machinery on Wages, p. 30.

[2] "Labor-saving methods seem to be a calamity, because the effect is to interfere with present pursuits and deprive some of their accustomed means of livelihood; to render useless, skill acquired after a lifelong training. The benefits all seem to accrue to the person who first uses an invention, while the ones displaced are apparently shut out of the industrial system. It is not noticed how they are gradually absorbed into other channels of employment that open up as the cost of production is decreased. If such were not the case, the whole industrial mechanism would soon come to a standstill, considering the progress of inventions supplemented by the army of aliens that arrive yearly and the increasing proportion of women breadwinners."—Henry White: "The Problem of Machinery" in *The American Federationist*, Vol. X, page 83.

As to those workmen who suffer only relative displacement there is, ordinarily, no need for any compensating advantages. The greatest hardship which the use of machinery lays upon them is that of avoiding those occupations in which the demand for workmen is becoming weak. It will be noticed too, that for every relative decrease in the number of persons engaged in one industry, there is a corresponding increase in some other industry.[1] As a matter of fact the persons engaged in gainful occupations constitute a greater proportion of the total population now than formerly.[2]

[1] See pp. 37–38.

[2] MALES AND FEMALES TEN YEARS OF AGE AND OVER IN THE UNITED STATES.

Year	*Total number*	*Engaged in gainful occupations.*	*Per cent*
1900	57,949,824	29,074,117	50.2
1890	47,413,559	22,735,661	48.0
1880	36,761,607	17,392,099	47.3
1870	28,228,945	12,505,923	44.3

Ranged on the common basis of 100, for the purpose of comparison, the two columns of absolute numbers in the above table show as follows:

MALES AND FEMALES TEN YEARS OF AGE AND OVER IN THE UNITED STATES.

Year	*Total number*	*Engaged in gainful occupation*
1900	205 2	232.5
1890	168.0	181.8
1880	130.2	139.1
1870	100.0	100.0

These figures show an unmistakable increase in the proportion of those engaged in clearly defined occupations. There are, however, two points which should be borne in mind in any comparative study of the census returns of occupations.

First: the more elementary the industrial organization, the less differentiated are the industrial functions, and hence the proportion of those who can report themselves as having definite occupations is much less than in a highly developed industrial organization in which the workmen are much given to following special lines of work.—(Tenth Census, Population I, page 710.)

Second: The number of different occupations reported upon has

THE AGRICULTURAL WORK OF FORMER TIMES IN THE TOWNS OF TO-DAY

The element of unreality in the transfer from agriculture to other occupations, referred to above (page 39), consists in this, that many of those who, at the present time, are employed in the towns and considered as engaged in occupations other than agriculture, are, in fact, doing work which, in earlier years, was done on the farms; and the persons who then did the work, if classified at all, were classified as agriculturists.

There is no need to cite authority for saying that 150 years ago, not in this country alone but in all countries, much of that which we now call manufactures was considered a part of agriculture. Agricultural implement manufacture, as a distinct industry, was then practically unknown. Each farmer, assisted, perhaps, by the village blacksmith, made his own implements. "Every homestead of any pretension had to be, at the same time, a manufactory of almost all the things required for daily use."[1] "Every housewife spun her own flax and made her own linen."[2] Even within

been repeatedly changed: the number of different occupations reported upon by the several censuses has been as follows:

Twelfth Census	303	Twelfth Census, Occupations, p. xxxii.
Eleventh Census	218	
Tenth Census	265	
Ninth Census	338	
Eighth Census	584	
Seventh Census	323	

Any one will readily recognize that the more minute the classification of occupations the higher must be the proportion of those in gainful occupations as compared with the whole population.

[1] Smith: Colonial Days and Ways, page 110.

[2] McMaster: History of the People of the United States. Vol. I, p. 10.

the past fifty years, the business of ginning cotton has been largely removed from the farm;[1] and, in the report of the Twelfth Census, cotton ginners are classed as manufacturers.[2] The business of cotton ginning like that of grinding corn and wheat, has become specialized and has been removed from the farm. Its classification as a line of manufactures followed, of necessity. The Twelfth Census classifies butter and cheese makers as manufacturers;[3] but in 1870, only the cheese makers were so classified.[4] Butter was made, in 1870, on the farms and as part of farm work. The development of the agricultural implement industry is another instance. The manufacture of the implements and machines from being a feature of farm work,[5] has become a distinct branch of manufactures, employing, according to the returns of the Twelfth Census, during the census year reported upon, an "average number[6]" of 46,582 persons besides 10,046[7] "salaried officials, clerks, etc."

Thus, one after another, functions which formerly were considered as belonging to agriculture have been differentiated from it and removed from the farm,

[1] Twelfth Census, Agriculture I, p .xxx.

[2] Twelfth Census, Population II, p. 507.

[3] Twelfth Census, Population II, p. 506.

[4] Ninth Census, Population, p. 680.

[5] Rogers: Industrial and Commercial History, p. 26.

[6] "The average number of wage-earners (men, women, and children) employed during the entire year was ascertained by using 12, the number of calendar months, as a divisor into the total of the average numbers reported for each month." Twelfth Census: Bulletin No. 69, p. 2.

[7] Twelfth Census, Manufactures IV, page 345. "More than two hundred thousand employees are provided with regular work the year round by the factories that make the implements and machinery, and nearly as many more are engaged in selling, transporting and shipping the products to their final destination."—Geo. E. Walsh; Machinery in Agriculture," in *Cassier's Mag.*, Vol. 19, p. 147.

until the farming business of to-day appears as a remnant of its former self. He is much mistaken, however, who would, from this fact, conclude that the farmer is sinking to the level of a wage-earner. One ought rather to say that it is a sign of the farmer rising to the position of a merchant or manufacturer. It is specializing his work; it is taking away only that which can be more advantageously done in the towns, and leaving to him just that which he can do most advantageously and, therefore, most profitably. It is lifting him to that place in the industrial organism in which his share in the production of economic goods counts most effectively.[1] The underlying and controlling fact is this: that the more highly organized society becomes, the farther it advances along the way from barbarism to a perfect civilization, the more does each individual member of society become dependent upon the offices of every other member.

The transfer of occupations from the country to the town is still going on and will go on until division of labor and labor saving devices shall have ceased to serve their purpose. It is in the nature of things that this should be so, since it can be done more economically; and it is equally in the nature of things that people should compete for the better conditions thus offered. It is in vain to try to keep the boy upon the farm where the work is slipping from his grasp. He must

[1] "Better methods of husbandry, the use of superior implements, specialization of agricultural production and vastly improved transportation facilities, whereby large areas of new lands have been brought under cultivation, have been indispensable to this increase in productive efficiency, in consequence of which a relatively smaller part of the world's population is required to produce the food supply."—C. F. Emerick: Agricultural Discontent," in Pol. Sci. Quar., Vol. XI, p. 436.

follow his work. The zeal which some townspeople manifest in their efforts to persuade the farmers' boys to remain upon the farm betrays a fear that the advent of vigorous blood may diminish the profit which now arises by reason of the somewhat restricted number of competitors.

It must, however, be noted that the introduction of farm machinery is developing work on the farm very much akin to that done in the town, as for example, the cutting and grinding of feed for stock. It minimizes the disagreeable features of farm work,[1] and is giving opportunity for the exercise of a higher order of intellect in farm work.[2] Many advantages, formerly attainable only in towns, are now accessible to the farming classes[3] so that, at the present time, many of the more capable farmers' boys are finding farm life to be the more advantageous avenue to the wealth and social position which they seek.

[1] "The introduction of machinery in many branches of industry—and more especially in agriculture—while increasing, perhaps, the monotony of employment, has also greatly lightened the severity of toil, and in not a few instances has done away with certain forms of labor which were unquestionably brutalizing and degrading, or physically injurious."—David A. Wells: Recent Economic Changes, p. 372.

"There is no more laborious kind of farm work than the spreading of manure; so much so that in farming on a large scale it is difficult to procure labor for the purpose. This can now be dispensed with. A machine called the manure spreader does all this work . . . It does everything in the manuring line except to use foul language."—*Scientific American Supplement*, Vol. 50, p. 20528.

[2] "The farmer has, by his own progressiveness, gained a better standing in business and in social life than he formerly held. The conditions on New England farms are now such as to attract men of brains and intelligence."—Chas. S. Phelps: "Is there a decadence of New England Agriculture," in *New England Magazine*, Vol. 25, p. 383.

[3] See page 71, *et seq.*

THE EFFECT OF THE USE OF MACHINERY UPON THE SIZE OF FARMS AND THE RESULTING RELATIONSHIP BETWEEN THE DEPENDENT AND THE INDEPENDENT FARMING CLASSES

The average size of farms of the Continental United States, and in the several divisions, as shown by the successive census returns from 1850 to the present, given in acres, is as follows:[1]

	1900	*1890*	*1880*	*1870*	*1860*	*1850*
United States	147.0	136.5	133.7	153.3	199.2	202.6
N. Atl. div.	97.5	95.3	97.7	104.3	108.1	112.6
S. Atl. div.	109.1	133.6	157.4	241.1	352.8	376.4
N. Cent. div.	145.2	133.4	121.9	123.7	139.7	143.3
S. Cent. div.	156.0	144.0	150.6	194.4	321.3	291.0
Western div.	393.5	324.1	312.9	336.4	366.9	694.9

An inspection of the foregoing table shows that for the period from 1850 to 1880, for the whole United States and for each division, except the South Central, in 1860, there was a constant tendency toward smaller farms. In the North Atlantic and South Central divisions this tendency is shown to have been still in operation in 1890 and the average size of farms in the North Atlantic division in 1900, although greater than in 1890, was still a trifle below the average shown for 1880. In the South Atlantic division the tendency toward smaller farms has continued unbroken to the present time; but otherwise, for the several divisions and for the United States, as a whole, the year 1880 marks the point of the smallest average sized farms. The returns subsequent to that date, except in the cases noted, show a marked increase in the average size of farms.

The total area in farms may, however, be somewhat misleading, when considered as an index of the extent

[1] Twelfth Census, Agriculture I, page 688.

of farming operations subject to the influence of machinery, as will clearly appear upon a comparison of the data in the table last above given with those of the following table showing the average number of acres of improved land, per farm, 1850–1900, inclusive.[1]

	1900	*1890*	*1880*	*1870*	*1860*	*1850*
United States	72.7	78.3	71.0	71.0	79.8	78.0
N. Atl. div.	57.4	64.3	66.6	68.3	69.0	69.3
S. Atl. div.	47.9	55.6	56.1	80.7	115.6	120.9
N. Cent. div.	101.2	95.8	80.6	69.7	67.7	61.0
S. Cent. div.	48.3	61.0	56.2	60.8	89.7	82.6
Western div.	111.8	157.8	185.9	168.1	106.4	51.8

By this table it appears, that the lowest average number of acres of improved land per farm, for the United States, as a whole, was reached in 1870; that this average was the same in 1880; and that while it rose somewhat in 1890, it fell again in 1900 almost to the level for 1870 and 1880. Turning to the several divisions we find that, with but one exception, the movement toward smaller farms continues and is apparent in the returns for 1900. The one exception is, however, all important in this discussion for it is the North Central division, the one above all others devoted to the use of farm machinery, and in this division it is shown, not only for the period from 1880 but for the whole period from 1850 to 1900, that there has been a strong and unvarying increase in the average number of acres of improved land per farm, rising from an average of 61.0 acres in 1850 to 101.2 acres in 1900.

The average number of acres in crops is a still better index to the extent of farming operations. Unfortunately, this average cannot be given for the whole of the period from 1850 to 1900; but for the more im-

[1] Twelfth Census, Agriculture I, p. xxii.

portant part of that period, namely from 1880 to 1900, it can be given with tolerable completeness. The following table shows the

AVERAGE NUMBER OF ACRES IN ALL FARM CROPS,[1] PER FARM OF TEN ACRES AND OVER IN 1880, 1890, and 1900.[2]

	1900	*1890*	*1880*
United States	49.8	48.6	42.6
North Atlantic div.	35.1	35.7	33.7
South Atlantic div.	29.4	33.4	36.2
North Central div.	73.0	65.1	51.5
South Central div.	33.6	34.3	34.6
Western div.	68.5	68.4	64.5

This last table agrees, in a general, with the corresponding portion of the table showing the average number of acres of improved land per farm; but it is to be noted that, according to the table now presented, the average crop area per farm is less, for the years 1890 and 1900 than for the year 1880, in only two divisions; namely, the South Atlantic and South Central. In each of the other divisions, and for the United States, as a whole, the average crop acreage per farm, both for 1890 and 1900, is greater than in 1880. The movement toward a larger average crop acreage is especially strong in the North Central division.

The relative strength of the tendency toward a greater average crop acreage per farm will be more readily appreciated if the facts disclosed in the foregoing table are presented from the basis of a common denominator, as follows:

[1] For acreage in all farm crops see p. 102.

[2] Number of farms derived from Twelfth Census, Agriculture I, pp. 688 and 690.

INDEX NUMBERS REPRESENTING THE AVERAGE NUMBER OF ACRES IN ALL FARM CROPS, PER FARM OF TEN ACRES AND OVER IN 1880, 1890, AND 1900

	Base	*1880*	*1890*	*1900*
United States	42.6	= 100	114.1	116.9
North Atlantic div.	33.7	= 100	105.9	104.2
South Atlantic div.	36.2	= 100	92.3	80.9
North Central div.	51.5	= 100	126.4	141.8
South Central div.	34.6	= 100	99.1	97.1
Western div.	64.5	= 100	106.0	106.2

There are three principal causes which have operated to produce the different conditions disclosed by this last table.

First: As between the North and South, there is a difference in the character of the workers. The negro workmen, as compared with the white workmen in the North and West, are lacking in the intelligence requisite for conducting extensive farming operations, as also for the using of machine power advantageously. This, coupled with the breaking up of the old plantation system, has tended to give smaller farms in the South Atlantic and South Central divisions.[1]

Second: The character of the principal crops cultivated in the Southern states are those in the cultivation of which, as compared with the crops raised in the Northern states, machine power is but little used. The only machine which plays any considerable part in the production of the distinctively Southern crops, is the cotton gin and the influence of this machine was in full operation long before the year 1880; whereas the influence of the machines used in the production of the distinctively Northern crops was, at that time, only fairly well under way.

Third: As between the North Atlantic, North Cen-

[1] Hammond: Cotton Industry, pp. 123–129.

tral and Western divisions, the character of the cultivation affects the size of farms. The North Atlantic states are much devoted to market gardening and the general character of farm work in that division is, therefore, more intensive and a given area gives employment for a greater quantity of both machine and man-labor power. The Western states, in like manner, much more than the North Central states, are devoted to market garden and orchard products.[1] The North Central states lead in what may be termed field crops.[2]

Looking to the total farm acreage, it may seem questionable whether the effect of machinery is to increase or decrease the size of farms. But it is noticeable that the total farm acreage includes land kept for stock-raising, for timber supply, for speculation, etc., and includes altogether too much of that with which machinery has nothing to do, to make it a fit basis for a study of the influence of farm machinery either upon the size of farms or upon the nature and extent of farm work. When we use the word "farm" to denote only that portion of the land with which machinery has to do (*i. e.*, the area devoted to the production of crops), it becomes apparent that, other things being equal, the use of farm machinery leads to, or is at any rate accompanied by, an increase in the size of farms. This increase is most marked in the states of the North Central division.

SOME CONSEQUENCES RESULTING FROM THE USE OF FARM MACHINERY IN THE REGION MOST DEVOTED TO ITS USE

It has been shown that the cereal and hay crops are those in the production of which machine power

[1] See Twelfth Census, Agriculture II, pp. 324 and 599 *et seq.*

[2] See pp. 52–53.

plays the greatest part. It now becomes needful to know the relative importance of the cereal and hay crops in the different divisions of the country. The following table shows for the United States and for the several geographical divisions, the total number of acres in all crops; the total number of acres in cereals and hay; and the per cent. which the total acreage in the cereals and hay bears to the total crop acreage, as reported by the census of 1900.

	Total crop acreage[1]	*Total acreage in cereals and hay*[2]	*Per cent*
United States	289,734,591	246,674,289	85.1
North Atlantic div.	24,683,365	21,876,493	88.6
South Atlantic div.	29,194,661	19,125,863	65.5
North Central div.	163,000,561	155,000,940	95.1
South Central div.	56,233,143	35,405,091	62.9
Western div.	16,622,861	15,265,902	91.8

For the purpose of further narrowing the field of investigation, it may be assumed also, as a matter of common knowledge, that, although machinery is much used in the production of hay, the work of hay production constitutes relatively but a small portion of the total work requisite for the production of both cereals and hay. It is, therefore, the cereal producing regions to which we must look for the most marked effects of the use of farm machinery.

The following table, taken from the report of the Twelfth Census,[3] indicates the distribution of the cereal crops and the relative importance of the cereal crops, from the standpoint both of acreage devoted to their production and of the value of the product as compared with the acreage and value of all crops.

[1] Twelfth Census, Agriculture II, p. 62.

[2] See p. 102.

[3] Twelfth Census, Agriculture II, p. 62.

	Per cent of acreage of all crops in cereals	*Per cent of value of all crops in cereals*	*Average value per acre of*	
			all crops	*cereals*
United States	63.8	51.0	$10.04	$ 8.02
North Atlantic div.	36.3	26.6	15.19	11.14
South Atlantic div.	58.1	33.6	11.32	6.55
North Central div.	73.2	71.1	8.42	8 18
South Central div.	56.1	36.3	10.99	7 12
Western div.	49.4	37.0	11.59	8.69

The North Central division ranked first in the production of cereals, not only in 1899, but also in 1889 and in 1879.[1] It ranked first also in the production of hay.[2] That it is the region of increasing average size of farms[3] and of increasing crop acreage per person engaged in farm work[4] has already been shown. The North Central states will, therefore, furnish the best field for a study of the effects of farm machinery.

Among the states of the North Central division there were seven which, for the year 1899, reported that over 70 per cent. of their total crop acreage was in cereals and also that the value of their cereal crops for that year constituted more than 70 per cent. of the value of their total crop production.[5] The seven states and the per cent. of their reported cereal acreage and cereal crop values to their total crop acreage and crop values, respectively, are as follows:[6]

[1] Twelfth Census, Agriculture II, p. 63.

[2] Twelfth Census, Agriculture II, p. 215.

[3] See pp. 47–50.

[4] See pp. 16–17.

[5] Oklahoma is the only other State, or Territory, in the Union which reported so high a per cent of acreage and value in cereals for the year 1899. But no separate report was returned for Oklahoma in 1880 and it is, therefore, necessarily omitted from this study.

[6] Twelfth Census, Agriculture II, p. 62.

State	*Cereal Acreage, of total crop acreage. Per cent*	*Cereal Value, of total crop value. Per cent*
Illinois	80.4	77.6
Iowa	76.3	76.9
Kansas	72.5	74.2
Nebraska	79.7	82.3
Minnesota	74.0	75.9
North Dakota	71.7	74.4
South Dakota	70.2	78.3

The hay and forage acreage of these seven states, in 1899, was 35.6 per cent. of the total hay and forage acreage of the United States[1] and their acreage in cereals and hay and forage was 96.6 per cent. of their own total crop acreage.[2] These seven states constitute, therefore, a region in which the cultivated area is almost wholly devoted to the production of those crops in the cultivation and handling of which farm machinery is most used. Their acreage in the different farm crops, as reported to the Census Office, for the period of 1880–1900 was as follows:

	1900	*1890*	*1880*
Cereals[3]	82,116,414	58,522,442	39,923,160
Hay and forage[4]	22,010,381	19,770,323	7,998,365
Tobacco[5]	2,587	4,500	6,906
Hops[6]	911	46	103
Cotton[7]	153	731	
Totals	104,130,446	78,298,042	47,928,534

The average acreage in farm crops, per farm of ten acres and over[8] was, in 1880, 64.4 acres; in 1890, 86.2

[1] Twelfth Census, Agriculture II, p. 215.

[2] The total crop acreage of these seven States in 1899 was 108,394,908 acres—Twelfth Census, Agriculture II, p. 62.

[3] Twelfth Census, Agriculture II, p. 63.

[4] *Idem*, p. 215.

[5] *Idem*, p. 527.

[6] *Idem*, p. 540; Eleventh Census, Agriculture II, p. 91 *et seq.*

[7] Twelfth Census, Agriculture II, p. 424.

[8] Tracts of less than ten acres are excluded as being vegetable, or truck farms, rather than farms for the raising of the crops here considered. For number of farms, see Twelfth Census, Agriculture I, pp. 688 and 690.

acres; in 1900, 102.5 acres. The average acreage in all farm crops, per person cultivating such crops,[1] was, in 1880, 40.6 acres; in 1890, 53.9 acres; in 1900, 62.4 acres.

Presenting these data in form to show the relative rates of increase, we have the following:

	Base	*1880*	*1890*	*1900*
Average acreage in all farm crops per farm	64.4	= 100	133.9	159.2
Average acreage in all farm crops per person cultivating same	40.6	= 100	132.8	153.7

The tendency in machine using states, toward a greater crop acreage per farm and per person, is strong and unmistakable.[2]

The persons who cultivated these crops are classfied as follows:[3]

	1900	*1890*	*1880*
Agricultural laborers[4]	612,418	359,894	352,565
Farmers, planters and overseers	1,056,237	1,091,867	828,800
Totals	1,668,655	1,451,761	1,181,365

Presented from the basis of a common denominator, these data show rates of increase as follows:

[1] Agricultural laborers, farmers, planters and overseers.

[2] "With the coming of the great harvesters, the planters, cultivators, and scores of other farm mechanisms there was an opportunity to double and quadruple the crops and the farms gradually increased from ten and twenty acres to one and two hundred."—Geo. E. Walsh: "Machinery in Agriculture," in Cassiers Mag., Vol. 19, p. 139.

[3] See table of absolute numbers, p. 100.

[4] This includes 4,264 garden and nursery laborers in the returns for 1900 and probably one-half as many of the same in the returns for 1890 and for 1880; but they were not separately reported by the Tenth and Eleventh Censuses, and hence cannot be discarded.

	Base	*1880*	*1890*[1]	*1900*
Agricultural laborers	352,565 =	100	102.1	173.6
Farmers, planters, and overseers	828,800 =	100	131.7	127.4

Disregarding the returns of the Eleventh Census, let us consider what these per cents indicate. Starting in 1880 with a given ratio between the number of farm employees and employers, we find that in twenty years the employed, or dependent class, has increased 73.6 per cent while the employing, or independent class, has increased only 27.4 per cent. In other words, during the twenty year period from 1880 to 1900, the dependent increased 46.2 per cent more rapidly than did the independent class. With these figures in mind, one needs but a moment's reflection to satisfy himself that, at the rates of increase indicated, the dependent class of farm operators must soon outnumber the independent class.[2] There is no need here for ar-

[1] The returns of the Eleventh Census are known to have been very defective in this, that "farmer's sons and daughters were often reported as farmers rather than as farm laborers, thus very much complicating the occupation returns in this class."—(Letter of Carroll D. Wright, under date of Dec. 29, 1899.) That some such error must have crept into the returns is evident on a consideration of the rate of increase of the two classes (*i. e.*, "agricultural laborers" and "farmers, planters, and overseers"), when taken together. The combined rate of increase appears as follows:

	Base	*1880*	*1890*	*1900*
Agricultural laborers, farmers, planters and overseers	1,181,365 =	100	122.9	141.2

These figures show that the total population engaged in farming increased at a uniform rate and there seems no good reason for supposing that there was in fact any such extraordinary movement from the class of employees to the class of employers and then back again within the period of twenty years from 1880 to 1900, as indicated by the returns.

[2] "Of these evils that which is most serious and general is the divorce which machinery is bringing about between labor and capital. So far has this already gone that people have come to think of the two as things naturally distinct from each other, and to regard it as a normal state of affairs that the persons who perform the manual toil of a country shall be absolutety dependent for employment on a com-

gument that a large dependent class is dangerous to society.[1]

The reason for this condition of affairs has been already indicated. The profitable use of a machine requires that it shall have a field of operation suited to its capacity;[2] just as a man, in order that he may work to best advantage, requires more and heavier labor than that suited to a boy. Hence the movement toward larger farms and greater average crop acreage per farm so noticeable in the machine using states. Moreover, the larger farms call for a corresponding increase in the amount of capital at the command of the farmer, especially when, as in this country, there is a tendency toward more intensive cultivation. This is equally true whether the farmer be an owner or a tenant. The

paratively small class known specifically as capitalists, in whose hands are concentrated the implements with which alone modern industry can be successfully carried on. That such dependence is unfavorable to the highest type of manhood will hardly be questioned; and the enormous extent to which machinery has increased and is still increasing the percentage of persons subject to such dependence is surely a most serious matter. The manhood of a nation is its most precious possession, for the loss or deterioration of which no increase of material wealth can adequately compensate."—Edward T. Peters: Some Economic and Social Effects of Machinery, p. 2.

[1] In 1890 the proportion of male agricultural laborers reported as unemployed during some portion of the census year was 17.2 %; in 1900 it was 36.1 %. Females, in 1890, 18.6 %; in 1900, 44.3 %.—Twelfth Census, Occupations, pp. ccxxviii–ccxxxi.

[2] "In order to make the steam power machines of value, the farms must be large and extensive. On small farms, they would prove too costly either in the operation or initial expense. For this reason it has been said that steam power could never supplant horse power on the farms, for our democratic notions demand that farming-lands shall never be consolidated in the hands of a few, and farming on a gigantic scale can never represent more than a very limited part of the industry in this country. Yet the tendency in the West is to operate enormous farms, combining several rather than cutting up into smaller ones."—Geo. E. Walsh: "Steam Power for Agricultural Purposes," in *Harper's Weekly*, Vol. 45, p. 567.

increasing amount of capital requisite for farm proprietorship makes it more and more difficult for a member of the dependent class (*i. e.*, an agricultural laborer), to become a proprietor.[1] His option to work for himself or to work for wages is more and more qualified, and hence the greater proportionate increase in the membership of the dependent class. That there has been a constant increase in the amount of capital requisite for farm proprietorship will be evident from an inspection of the following data, showing for this group of seven states, as reported to the Census Office:

1. The average value, per farm, of all farm property, including land with improvements, implements and machinery, and livestock was in 1880, $3,515; in 1890, $4,859; in 1900, $6,531.[2]

2. The average value, per farm, of lands with improvements, including buildings was in 1880, $2,835; in 1890, $3,930; in 1900, $5,358.[3]

3. The average value, per farm, of implements and machinery on farms: In 1880, $136 was in 1890, $151; in 1900, $208.[4]

The rate at which these several factors have increased will appear in the following:

[1] "No English agricultural labourer, in his most sanguine dreams, has the vista of occupying, still less of possessing, land. He cannot rise in his calling. He cannot cherish any ambition, and he is in consequence dull and brutish, reckless and supine."—Rogers: History of Agriculture and Prices, Vol. I, p. 693.

[2] Twelfth Census, Agriculture I, pp. 688 and 694.

[3] *Idem.*, pp. 688 and 696.

[4] *Idem.*, pp. 688 and 698.

	Base	1880	1890	1900
Average value of all farm property	$ 3,515	= 100	138.2	185.8
Average value of farms (land and improvements)	2,835	= 100	138.6	189.0
Average value of implements and machines	136	= 100	111.0	152.9
Farmers, planters and overseers	828,800	= 100	——	127.4
Agricultural laborers	352,565	= 100	——	173.6

WAGES UNDER HAND AND UNDER MACHINE METHODS

DAILY WAGES—WAGES OF SKILLED AND UNSKILLED WORKMEN

Touching the matter of daily wages for the same work under hand and under machine methods of production, the Thirteenth Annual Report of the Department of Labor is, probably, the best source of information. That report shows, in typical cases, the rates of wages paid for the different kinds of work required in the production of twenty-seven different farm crops by hand and by machine methods. The data in twenty-six cases are available for our present purpose.

It appears by that report that the lowest wage customarily paid, in the season of 1829–30, to any workman engaged in the production of wheat, by hand method, was 50 cents; the highest 75 cents. In 1895–96, the lowest daily wage reported for workmen engaged in the production of wheat, by machine method, was $1.50; the highest, $4.50. The average rate of wages for this work, in 1829–30, was 57 cents; in 1895–96, it was $2.47.[1] Collecting similar data from each of the twenty-six sets of usable returns, we have the following:

[1] The average here used is a weighted average, secured by dividing the total amount of wages paid by the total number of days work performed at the different rates of wages.

DAILY WAGES

Unit No.*	Crop.	Hand Labor Date.	Machine Labor Date.	Hand Method.		Machine Method.		Av. Daily Wages.	
				Lowest.	Highest.	Lowest.	Highest.	Hand.	Machine.
1	Apple Tree . .	1870–2	1893–5	$.85	$2.00	$.85	$2.00	$1.56	$1.59
2	Apple Tree . .	1869–71	1893–5	.85	2.00	.85	2.00	1.56	1.28
3	Barley	1829–30	1895–6	.50	.75	1.50	4.50	.56	2.21
4	Beets	1850	1895	.40	.75	1.00	1.00	.69	1.00
5	Broom Corn . .	1860	1895	.50	1.00	1.25	1.50	.99	1.25
6	Carrot	1855	1895	.40	.75	.75	1.25	.62	1.01
7	Carrot	1850	1895	.40	.75	.75	1.25	.72	.90
8	Corn	1855	1894	.75	1.00	1.00	2.50	.78	1.53
9	Corn	1855	1894	.50	1.00	1.00	1.00	.94	1.00
10	Cotton	1841	1895	.50	.50	.50	1.00	.50	.99
11	Hay	1860	1894	.50	1.00	.75	1.25	.86	1.11
12	Hay	1850	1895	.50	1.00	.75	1.25	.83	1.05
13	Oats	1830	1893	.50	.75	1.25	2.50	.56	1.50
14	Onion	1850	1895	.40	.75	.75	1.25	.70	1.00
15	Peas	1856	1895	[1].62½	[1].62½	[1]1.00	[2]2.00	[1].62½	[1]1.04
16	Potato	1866	1895	1.00	1.00	1.00	1.00	1.00	1.00
17	Rice.	1870	1895	1.00	1.00	.65	.65	1.00	.65
18	Rye.	1847–8	1894–5	[1] .63	[1] .75	[1]1.00	[1]2.00	[1] .65	[1]1.05
19	Strawberry . .	1871–2	1894–5	. .	. .	.		1.30	1.38
20	Sugar Cane . .	1855	1895	1.00	1.00	.65	.65	1.00	.65
21	Sweet Potato .	1861	1895	.50	1.00	.40	.80	.76	.62
23	Tobacco	1844	1895	[1] .75	[1] .75	[1]1.00	[1]1.00	[1] .75	[1]1.00
24	Tomato	1870	1895	.50	1.00	. .	. .	.93	.91
25	Turnip	1855	1895	.40	.75	.75	1.25	.59	.88
26	Wheat	1829–30	1895–6	.50	.75	1.50	4.50	.58	2.00
27	Wheat	1829–30	1895–6	.50	.75	1.50	4.50	.57	2.47

* See footnote "1", p. 21.

It is evident from an inspection of the foregoing table that the variation between the highest and lowest rates of daily wages is much greater under machine methods than under hand methods and that the average rate of wages is much higher under machine methods than under hand methods. An average of averages gives 83 cents for the hand method, $1.19 for machine method.

Of course, machine power is much more used in the production of some of these crops than in the production of others. In several cases, production is still almost wholly by hand method.[2] In such cases the

[1] With board.

[2] Thirteenth Annual Report, Dept. of Labor, p. 11.

data are not what they appear to be—a showing of hand method as compared with machine method,—but rather only a showing of production by hand method at different dates.

It will be worth our while to inquire in what way the introduction of machine power has affected the rates of wages for the work of producing these different crops. Turning first to a consideration of wages paid in the production of five crops, now largely produced by machine power, we collect the following data:

Unit Number	*Crop*	*Average daily wages*	
		Hand	*Machine*
3	Barley	$.56	$2.21
8	Corn	.78	1.53
11	Hay	.86	1.11
13	Oats	.56	1.50
27	Wheat	.57	2.47

An average of averages gives 66 cents for the hand methods and $1.76 for the machine method,—an increase of 166 per cent.

A similar showing for the five crops in which there appears to have been little or no change in the methods of production, is as follows:

Unit Number[1]	*Crop*	*Average daily wages*	
		Hand	*Machine*
2	Apple trees	$1.56	$1.28
16	Potatoes	1.00	1.00
19	Strawberries	1.30	1.38
21	Sweet potatoes	.76	.62
24	Tomatoes	.93	.91

An average of averages gives $1.11 as the average daily wage in the time of hand methods and $1.04 as the average daily wage in the time of machine methods,—a decrease of 6.7 per cent.

[1] See footnote 1 p. 21.

The position of the unskilled workman[1], meaning now the workman who is untrained in the use of machinery, is a peculiar one. In a lecture on ballad poetry, delivered at the University of Wisconsin in the Spring of 1903, Professor Moulton, of the University of Chicago, called attention to the fact that before the time of written literature the best literary productions were equally accessible to the free and to the unfree. The slave, as well as his master, might know and enjoy the choicest of literary productions. But, with the invention of writing and, especially, of printing, the best literature came to be put into book form. Books were expensive and the knowledge requisite for using them could be acquired only by a long and difficult course of training. From the very nature of the case, the best literature thus became inaccessible both to the slaves and to the poorer classes of freemen. They could gain no positive advantage from the new invention; and they lost, relatively, by reason of the intellectual gulf which opened between them and those others whose more fortunate stations gave both access to the written or printed volumes and afforded opportunity for learning how to use them.

This same process is now working itself out in the matter of labor and machinery. To the skilled

[1] There is, I think, a great deal of confusion and consequent misunderstanding arising from a loose use of the term "unskilled workman." We speak of paying higher wages to a skilled workman than to an unskilled workman; but, the essential element is not skill but efficiency. Skill, means rather proficiency, or dexterity, in the doing of a particular thing. It has reference to the person. But when we speak of a skilled machine workman, we have reference, not so much to the quality of the worker as to the quality of the work done, that is, to the product of his skill. The degree of skill which the machine workman possesses may, in fact, be much below that of the hand worker whom he displaces; but he is a more efficient workman and, therefore, commands the higher wage.

workman, machinery opens the way to profit and advancement. But to the unskilled workman, it is as a sealed, or unintelligible, book. He does not understand it; and the hopelessness of competing with one who does understand it, only intensifies his consciousness of inferiority and increases the burden of his struggle for existence.[1] Having, ordinarily, neither machinery nor the capacity for using it, he is practically shut out from all chance of participating in its benefits. His wages, of necessity, are limited by the standard of his efficiency. It is inevitable, therefore, that the unskilled laborer should, relatively, at any rate, sink ever lower and lower in the scale of industrial society.

That we have been experiencing a transition period, not only with respect to the agricultural industry [2] but, also, with respect to all other industries, seems almost self-evident. I do not believe that the transition period is passed, nor do I believe that it ever will be safely and finally passed, until the State, in the interest of the general welfare, and in its capacity of agent for the whole social body, shall have provided for and required, as now so all but universally provided for and required, in the more purely intellectual field, that every child shall be taught, at least, the rudiments of industrial art.

[1] "Under conditions where the laborer can offer no resistance and the so-called iron law of wages operates to keep him down to the life line, machinery only adds uncertainty to his other woes. He is, as it were, cut out of civilization. Whenever he presses upward and secures a larger share of an ever enlarging product, machinery becomes an uplifting force."—Henry White: "The Problem of Machinery," in *American Federationist*, Vol. X, p. 86.

[2] "The introduction of improved agricultural implements and machinery during the latter half of the nineteenth century was a development of such importance as to amount to an industrial revolution in agriculture."—Report of the Industrial Commission (1901), Vol. X, p. xiv.

MONTHLY WAGES—SYMPATHETIC VARIATIONS IN WAGE RATES

McMaster[1] cites authorities showing that, in 1794, "in the States north of Pennsylvania," the wages of common laborers did not exceed three dollars per month, while "in Vermont, good men were hired for eighteen pounds a year, which was equal to four dollars per month, and out of this found their clothes." Speaking of wages, generally, in 1802, he says:[2] "The average rate of wages the land over was sixty-five dollars a year, with food, and, perhaps, lodging." In 1811, "throughout central Pennsylvania eight dollars per month of twenty-six working days, was paid to farm hands when fed and clothed."[3] At Adrian, Michigan, in 1849, according to an apparently reliable authority: "The most common labor with board is worth from $50 to $75 a year. A higher quality, in which some care and responsibility are added, is worth $100 to $120."[4] A similar report from Richmond, Massachusetts, made in the same year, states: "Men get from ten to sixteen dollars per month and boarded, for six months commencing in April."[5]

On the period from 1866 to 1899, I quote from a report of the Department of Agriculture,[6] as follows:

[1] McMaster: History of the People of the United States, Vol. II, p. 179.

[2] *Idem.* Vol. II, p. 617.

[3] *Idem.* Vol. III, p. 510.

[4] U. S. Patent Office Report, 1849–50, p. 186.

[5] *Idem.* 1849–50, p. 92.

[6] Division of Statistics, Misc. Bull. No. 22, p. 16.

WAGES OF FARM LABOR PER MONTH, BY YEAR OR SEASON, WITH BOARD, BY YEARS AND BY GEOGRAPHICAL DIVISIONS.[1]

	1899	*1898*	*1895*	*1894*	*1893*	*1892*	*1890*
U. States	$14 07	$13 43	$12 02	$12 16	$13 29	$12 54	$12 45
E. States	18 21	17 63	17 73	17 15	18 45	17 50	17 71
M. States	15 93	15 33	15 73	15 60	16 51	15 78	15 61
S. States	9 70	9 45	8 68	9 04	9 92	10 02	10 10
W. States	16 70	15 75	15 21	14 96	16 29	15 36	15 00
Mt. States	25 10	23 94	19 87	19 94	23 37	21 28	20 64
Pac. States	24 97	23 30	20 54	22 60	25 63	24 25	22 50

	1888	*1885*	*1882*	*1879*	*1875*	*1869*	*1866*
U. States	$12 36	$12 34	$12 41	$10 43	$11 07	$11 03	$12 38
E. States	17 21	16 70	16 92	13 03	16 18	15 29	14 77
M. States	15 41	15 24	14 71	12 37	14 78	12 85	13 33
S. States	9 90	9 90	9 92	8 46	8 65	7 03	7 62
W. States	15 09	15 20	15 60	12 75	13 43	11 36	12 09
Mt. States	21 99	19 74	27 08	— —	— —	— —	11 78
Pac. States	25 08	24 37	23 73	25 88	28 12	25 44	29 47

The Department of Agriculture has also reported on the "wages of farm labor per month, by year or season, with board," for the year 1902.[2] The average rate for

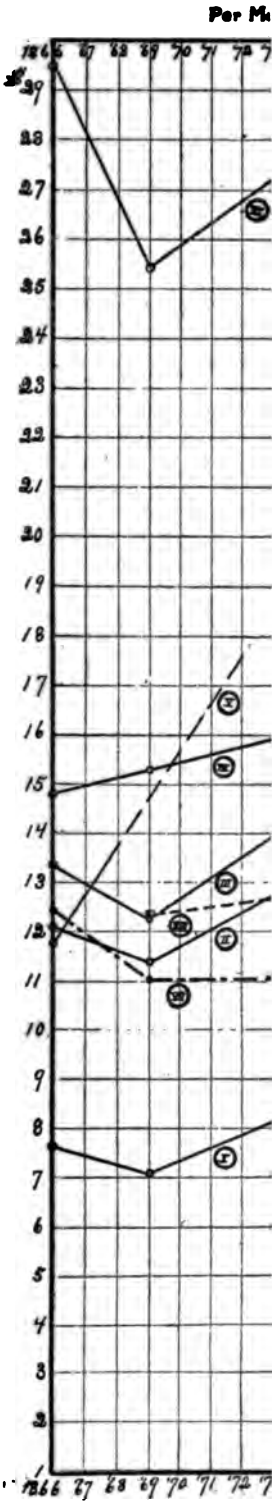
[1] The geographical divisions used in this table "are composed as follows: *Eastern States*—Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut; *Middle States*—New York, New Jersey, Pennsylvania, Delaware; *Southern States*—Maryland, Virginia, South Carolina, North Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, Texas, Oklahoma, Indian Territory, Arkansas, Tennessee; *Western States*—West Virginia, Kentucky, Ohio, Michigan, Indiana, Illinois, Wisconsin, Minnesota, Iowa, Missouri, Kansas, Nebraska, South Dakota, North Dakota; *Mountain States*—Montana, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, Idaho; *Pacific States*—Washington, Oregon, California." Depart. of Agr.; Division of Statistics, Misc. Bull. No. 22, p. 16.

The data for the years prior to 1879 have been changed to a gold basis and a correction has been made, of what was evidently a clerical error, in the rate reported for the Western States in 1866. For the purpose of making this correction the cost of board in the Western States, in 1866, was assumed to have been the same as in the Pacific States where wages without board were practically the same at that date as in the Western States.

[2] Department of Agriculture (Div. of Stat.), Misc. Bull., No. 26, p. 15.

the whole United States is given as $16.40; but the average rates for the several geographical divisions are not given. In a letter dated September 16, 1904, the Secretary states that it was deemed unwise for the department so to extend the report on this last investigation. He suggests, however, that for the purposes of this study it would be allowable to make use of such "apparent" averages as are indicated by the published report. Agreeable to this suggestion, I have averaged the wages reported for the states in the several groups and secured the following as the average wage rates in 1902: Eastern States, $19.85; Middle States, $16.61; Southern States, $11.85; Western States, $19.48; Mountain States, $28.91; Pacific States, $27.90. These figures are averages of averages and must, therefore, be taken with some allowance. Accepting, as true, the average rate for the several states, as reported by the department, the rate here given for the Middle States is clearly too low since Delaware, whose wage rate was $13.81, is given equal weight with New York, whose wage rate was $19.65. The rate here given for the Pacific States is likewise too low since Oregon, whose wage rate was $25.98, is given equal weight with California, whose wage rate was $29.38. For the Southern and for the Western States the rate here given is probably too high, the highest rates being reported for the less populous states. For the other groups the rates here given are approximately correct.

By reference to the accompanying chart it may readily be seen that the average rate of wages for the whole of the United States was somewhat higher in 1899 and in 1902 than in 1866. It is very evident, however, that


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the line of wages for the whole of the United States is very largely controlled by the wage rates in the "Southern States." It is hardly fair to strike an average of wages by considering together the wages of two such different classes of people as the whites and the blacks. We can avoid this incongruity for a considerable portion of the period under consideration.

Taking the number of agricultural laborers in the Mountain, Pacific, Eastern, and Western States *i. e.*, the whole of the United States, exclusive of the Southern States), to have been in 1899, as reported in 1900, we find that the average rate of wages per month, with board, was, in 1899, 17.31.[1] In like manner, the average monthly wage, in the same region, in 1890, is found to have been $15.81; in 1879 it was $13.14;[2] in 1869 it was $12.29.[3] The increase in the average rate per month, during the period from 1869 to 1899, was 40.8 per cent.

[1] In getting this average, I found first the total number of agricultural laborers in each of the geographical divisions named and then found the total wage payment in each group at the rates given in the table on p. 65. The sum of these wage payments divided by the total number of agricultural laborers in all the groups, gives the quotient $17.31.

[2] The number of agricultural laborers in 1879 is assumed to have been the same as that reported in 1880 and the average rate of wages in the "Mountain States" is assumed to have been the same as was reported for the Pacific States.

[3] The number of agricultural laborers in 1869 is assumed to have been the same as was reported in 1870 and the average rate of wages in the Mountain States is assumed to have been the same as was reported for the Pacific States.

In the matter of the 20,321 agricultural laborers reported by the Ninth Census as being in the Territories, it should be noted that these have been apportioned somewhat arbitrarily, as follows: To the Mountain States, 15,000; to the Pacific States, 1,500; to the Western States, 3,821.

In the matter of general well-being the agricultural laborers, in the North, at any rate, have, of course, shared the homes of their employers; clothing has certainly been cheaper in late years; and, altogether, it seems safe to say that the condition of the dependent white agricultural laborers is much improved.[1]

The accompanying chart discloses a very strong tendency in the wage rates of the different parts of the country, especially in the region where white laborers are employed, to rise or fall together. The reason for this sympathetic fluctuation in rates lies, partly, in the somewhat characteristic dispositions of Americans to go wherever there is a prospect of more profitable employment,[2] and partly in the ready means of communication and

[1] "Eine weitere Verbesserung des Arbeitereinkommens ist in der vermehrten Kaufkraft des Geldes zu suchen. Sowohl die Kleidungsstücke als auch andere Gebrauchsartikel sind durch die hervorragende Anwendung der Machinenarbeit in der Industrie bedeutend im Preise heruntergegangen; dazu sind auch die Lebensmittel meistens billiger zu kaufen. Der Arbeitslohn ist also nicht nur im allgemeinen absolut, sondern auch im Verhältnis zu dem Preise der notwendigen Lebensmittel gestiegen. Inwieweit allerdings die landwirtschaftlichen Maschinen zur Verbilligung der Lebensmittel beigetragen haben, lässt sich zahlenmässig nicht bestimmen. Wir können uns sehr wohl denken, dass die Intensität des Betriebes, die Anwendung der Maschinen, die Produktion so gesteigert haben, dass sie eine Verbilligung der Lebensmittel zur Folge hatten Wir denken dabei besonders an das klassische Land der Maschinenanwendung, an Amerika, welches noch vor wenigen Jahren der deutschen Getreideproduktion am gefährlichsten war. Wie hoch sind dort die Arbeitslohne und wie billig ist das Getreide!" Bensing: Einfluss der landwirtschaftlichen Maschinen, S. 73.

[2] "The United States perhaps affords the highest example of a body of labor prepared and equipped to seek its best market wherever that market may be." Walker: "Wages," p. 180.

"L'Americain de pur sang a cela de commun avec le Tartare, qu'il est campé et non fixé sur le sol que ses pieds foulent." M. Chevalier: Lettres sur l'Amerique du nord, Tome I, p. 196.

transportation.[1] That the fluctuations are most marked in the "Pacific" and "Mountain" States, is largely due to the less perfect means of communication and transportation and to the further fact that farming operations in those regions are rather closely confined to the production of a very few different crops, upon the productiveness of which depends practically the whole of the demand for labor.[2]

THE INFLUENCE OF MACHINERY UPON THE LIFE AND GENERAL WELFARE OF THE INDEPENDENT FARM OPERATORS

Statistical data showing the changed condition of the independent farm operators, separate and apart from the dependent operators, are not at hand. It will be worth while, however, to note what showing can be deduced concerning the income of the independent farm operators from the average income per agricultural worker during the twenty-year period from 1880 to 1900.

The value of agricultural products, per capita of person ten years of age and over engaged in agriculture, as reported by the Tenth, Eleventh and Twelfth Censuses

[1] "The mobility of capital and labor depend upon two factors, (a) means of transport, (b) knowledge of markets. Both of these elements have been influenced by machinery." Nicholson: Effects of Machinery on Wages, p. 104.

[2] "The greatest irregularity of employment in the North, particularly in the Northwest, is found where the farmers are engaged in raising one or two staple crops to the neglect or exclusion of any wide system of diversified industry. . . . There was of that irregularity far more in the early days of the West than there is to-day, because the great central States of the North, where over half of our products are raised, are tending naturally and inevitably, though slowly, toward a diversity of crops that keep the men engaged on the farms for a greater relative proportion of the year; and thus irregularity of employment, owing to this change, is decreasing." L. G. Powers in Rpt. of Ind. Com. (1901), Vol. X, p. 172.

for the United States and for the several geographical divisions, was as follows:[1]

	1900	*1890*[2]	*1880*
United States	$454.37	$287.19	$286.82
North Atlantic div.	620.20	380.47	420.41
South Atlantic div.	229.01	175.46	165.26
North Central div.	672.59	357.05	369.39
South Central div.	269.19	206.89	187.87
Western div.	723.72	433.95	506.25

Considering only the data for the United States, as a whole, we have found[3] that in 1879, 1890 and 1899, the average monthly wage of dependent farm workers was, respectively, $10.43, $12.45, and $14.07, an increase of 34.9 per cent. in the twenty-year period. But the average value of agricultural products per farm worker for the years 1880, 1890, and 1900 was, respectively, $286.82, $287.19, and $454.37, an increase of 58.4 per cent. for practically the same twenty-year period.[4]

It is self-evident that if the increase in the income of the dependent class alone is represented by 34.9 per cent., while the increase in the income of all agricultural workers—dependent and independent taken to-

[1] For data of value of products see Twelfth Census, Agriculture I, p. 703. For number of persons in agriculture, see p. 93 of this study.

[2] The low valuation reported by the Eleventh Census was not the result of a decreased production; but rather, if it can be proper to use the term at any time, to an over-production. Take, for illustration, the case of corn: The corn crop produced in 1889 (the crop reported upon by the Eleventh Census), was so greatly in excess of the production in previous years that not only the price per bushel but the total value of the crop fell below that reported for any one of the nine preceding years. The same statement applies, more or less, to most of the staple farm crops for that year. See Dept. of Agr., Year Book (1901), pp. 699 *et seq.*

[3] See p. 65.

[4] Excluding the "Southern States," the corresponding showing for this twenty-year period is, for dependent workers, an increase of 31.7 per cent; for all farm workers, 71.2 per cent.

gether—is represented by 58.4 per cent., then the increase in the income of the independent class alone could be indicated only by a much higher number. How much higher we cannot tell, probably not less than 75 or 80 per cent. For the period from 1850 to 1900 the rate should, doubtless, be more than doubled.

The independent farmer of the present day, who has hired workmen, does not find it needful to work always at the same laborious tasks he sets for his employees. At harvest time, it is not the hired man but the farmer himself who tends the machines and does the lighter work. Farm buildings are more substantial and supplied with more conveniences than they were fifty, or even twenty, years ago. Good roads abound, and, probably not less than one-fourth of the farmers now have the advantages of a free delivery of mail.[1] Telephone service between farm houses and connecting with the neighboring towns, or cities, is by no means uncommon. Railway and electric car lines run through the farming districts and where formerly there was a back-country farm house there is now, not infrequently, a suburban home. These advantages enable the modern farmer to keep well abreast of the times and to inform himself concerning measures and events nearly, if not quite as well, as the average resident of the towns.[2]

[1] The Superintendent of Free Delivery, in a letter dated January 27 1903, stated that on February 1, 1903, there would "be 13,108 rural routes in operation" and that each carrier "serves an average of 100 families."

[2] "The social and ethical sides of farm life are also making progress through the freer intercourse with the world, afforded by improved highways and by the extension of trolley lines. The contact of the younger generation with the life of the city is making new and more progressive methods of living almost a necessity. To-day, on many farms, the 'best room' is none too good for the family. Musical instruments are found in a large proportion of the country homes; a daily paper, some of the best magazines, and often the leading novel

It is rare indeed that the farmer of the present day cannot afford to send his children to school for at least six months of each school year during the greater portion of their school age. Our High Schools and Universities and especially our Agricultural Colleges which, twenty years ago, were hardly known, except on paper,[1] furnish ample evidence both of the greater interest of the farming classes in higher education and of their fitness for the higher lines of work.

Whether we look to the external signs of comfort and general welfare or to the character of the farm houses, there appears overwhelming evidence of a great change for the better with respect both to the dependent and independent classes,[2] the greater advantage appearing, however, to be in favor of the independent class.

To ascribe these improved conditions to the introduc-

of the day are not uncommon. . . . The attractiveness of our rural communities is growing. The movement of the population which has been so strongly toward the cities is now turning toward the country. Improved highways and the extension of trolley lines are bound to encourage this tendency. If formerly country people have sought homes in the cities, it is evident that the people of to-day are appreciating, as never before, that the country offers the strongest inducements for the building up of homes where health and the comforts of life can be enjoyed." Chas. S. Phelps: "Is there a Decadence of New England Agriculture," in *New Eng. Mag.*, Vol. 25, p. 382–3.

[1] Department of Agriculture, Year Book (1899), p. 173

[2] "But most have a false idea of farm life as it is to-day. The wife need not be the drudge she was once. Bearings have shifted, things are done differently, life runs smoother and better. More is accomplished with less wear of muscle and nerve. People work easier and do more, have greater leisure for recreation and self-culture. Much that the wife did formerly is provided for in other ways. . . . Advanced methods have made farming more profitable, easier indoors and out, have carried to the thinly settled country most of the refining influences and many of the advantages of city life." Clarence E. Blake: "Abandoned Farms as Homes for the Unemployed and City's Poor," in *New Eng. Mag.* (N. S.), Vol. 24, p. 582.

tion and use of machine power alone would, doubtless, be to overstate the truth, and yet, even waiving the impracticability of providing the requisite food supply by the earlier methods of culture, it is not at all clear that, under those earlier methods of heavy and exhaustive toil, men could be able effectively to interest themselves in affairs of government, social relations, and education in any degree comparable to that now common among the farming classes in this country.[1]

Consider how much lighter farm work now is than it was fifty years ago, before the introduction of machinery. How infinitely easier it must be to ride in the spring seat of a reaping machine, with no harder task at hand than that of keeping the horses out of the grain, than it would be to shuffle wearily along that same way, with bended back and with the perspiration springing from every pore, cutting an eight or ten foot cradle swath. And how much preferable to pitch sheaves to a threshing machine, or to work on the straw stack for a day or two than to labor all through the winter months flailing and winnowing grain.[2] It is much more delightful to have a sulky plow, with the option to walk or to ride, as inclination may direct, than to be compelled to trudge all day over the yielding soil, till your limbs grow heavy and you stumble at

[1] "The elimination of exhausting manual labor by the substitution of powerful machinery for puny arms has emancipated labor in our day from its hardest tasks, and has given to the worker both inclination and leisure for the development of his intellect in various ways that were impossible under former conditions." A. E. Outerbridge, Jr.: "Machinery and the Man," in Scientific American Supp., Vol. 51, p. 21235.

[2] "Threshing was then, as it remained till our time, when it has been almost superseded by machinery, the chief farm-work of the winter." Rogers: History of Agriculture and Prices, Vol. I, p. 15.

evening when you strike the beaten pathway leading to your home.[1]

The ultimate and general effect of machinery upon farm laborers and, of course, upon all farm workers, has been quite thoroughly and pretty accurately summarized as follows: "As to the influence of machinery on farm labor, all intelligent expert observation declares it beneficial. It has relieved the laborer of much drudgery; made his work easier and his hours of service shorter; stimulated his mental faculties; given an equilibrium of effort to mind and body; and made the laborer a more efficient worker, a broader man, and a better citizen."[2]

The work of women on the farms has been much lightened by machine power; not so much, however, by machines with the aid of which a woman does the same work as formerly as by machines which have taken the work entirely from the farm,[3] as for example, spinning and weaving, soap-making,[4] and candle-making,[5] which were formerly well-accepted parts of women's work on the farm and generally, also, in the towns. At the present time, throughout probably the greater part of the country, cheese and butter making is ordinarily done away from the farm and, in some parts of the country, as, for instance, in North Dakota, even the

[1] "To follow the team in the furrow, day after day, is very tiresome work and has the effect of giving the boy a heavy awkward gait by stiffening the lower limbs—a condition from which he seldom if ever recovers." M. L. Dunlap: U. S. Agricultural Report (1863), p. 417.

[2] J. R. Dodge: "American Farm Labor," in Rept. of Ind. Com. (1901), Vol. XI, p. 111.

[3] McMaster: History of the People of the United States, Vol. I, p. 97.

[4] Smith: Colonial Days and Ways, pp. 69 and 115.

[5] Earle: Home Life in Colonial Days, p. 35.

coming of a threshing crew fails to add materially to the work of the women on the farm, for the crews bring a cook-wagon and provide their own meals.[1]

Of the machines used by women on the farm, that of the sewing machine is, doubtless, first in importance; the washing machine and the apple-paring machine are contrivances of no mean worth. For the rest, there may be found, instead of the andiron and crane, or the 'Dutch oven' and 'out oven' of pioneer times,[2] very conveniently arranged stoves and ranges; also egg-beaters and can-openers and a host of other articles of which the house-wife of fifty years ago knew nothing, not to mention incubators, milk separators, etc. The most of these things belong rather in the class of tools and utensils; nevertheless, they indicate the lighter character of the work which women have now to do on the farms than fell to the lot of women before the era of machine power made such conveniences possible.

THE INFLUENCE OF MACHINERY UPON THE PHYSICAL AND MENTAL NATURE OF MAN

It may be assumed that the occupation of a man goes far toward determining his physical and mental health.[3] This fact is indeed, as I understand it, the basis of much of the argument both for and against the use of machine power. So far as routine work is concerned I venture to say that the evil is not inherent in, nor peculiar to the use of machine power.

The primary purpose and usual effect of the use of

[1] Report of the Industrial Commission (1901), Vol. X, p. 851.

[2] McMaster: History of the People of the United States, Vol. V, p. 154.

[3] Farr: Vital Statistics, p. 394 *et seq.*

any machine, is the production of utilities at a less expenditure of time, energy, and money.[1] But this is only another way of saying that, when aided by machine power, a given expenditure of time, energy, and money will produce a greater quantity of utilities. Utilities are the means of satisfying wants; and the satisfaction of wants is essential to life and happiness. The use of machinery, by supplying wants, does therefore, one of two things; either it "enables a larger number of persons to get a living", or it enables a given number "to get a better living."[2] Anyone will, I think, admit that the utilities supplied by machine power have not all been consumed in better livings. A very great part of this additional means of satisfying wants has been devoted to the maintenance of a more numerous population. That this is true must be self-evident when we consider how greatly the supply of utilities has been increased by the use of machinery,[3] and how utterly impossible it would be for the labor force now in existence, unaided by machinery, to provide even the ordinary necessities of life as we now count necessaries.[4]

[1] "Les outils ne sont que des machines simples et les machines ne sont que des outiles compliqués que nous ajoutons à nos bras pour en augmenter la puissance; et les uns et les autres ne sont, à beaucoup d'égards, que des moyens d'obtenir le concours des agens naturels. Leur résultat est évidemment de donner moins de travail pour obtenir la même quantité d'utilité, ou, ce qui revient au même, d'obtenir plus d'utilité pour la même quantité de travail humain." J. B. Say, Traité d'Economie Politique, p. 85.

[2] Powers: Labor Making Machinery, p. 27.

[3] See pp. 22–23.

[4] "Selbst der Aermste hat in unserer Arbeitstheilung doch mehr zu geniessen als wenn er im ungeselligen Zustand lebte: die bei uns am übelsten gestellt sind, Kränkliche ohne Vermögen, Familienväter mit allzu vielen Kindern, etc., würden im Urwalde einfach verhungern." Roscher: Grundlagen der Nationalökonomie (edition of 1900), p. 166.

By lightening the tasks of those who labor with their hands, and by increasing the quantity of the necessaries of life which a given amount of labor can procure, machinery has not only favored a higher standard of living, but has increased the chances of attaining it.[1] Moreover, the use of machine power has made it possible for many now to devote themselves wholly to intellectual pursuits without involving either the enslavement or the degradation of others.[2]

Looking at the question from the standpoint of the whole social body, there can be no other conclusion than that the use of machinery, by increasing the supply of utilities and by making utilities more accessible,[3] has

[1] "To-day the world obtains commodities of excellent quality at prices which even the preceding generation would have deemed incredible The poor enjoy what the rich could not before afford. What were the luxuries have become the necessaries of life. The laborer has more comforts than the farmer had a few generations ago. The farmer has more luxuries than the landlord had and is more richly clad and better housed. The landlord has books and pictures rarer, and appointments more artistic, than the king could then obtain." Carnegie: The Gospel of Wealth, p. 4.

[2] "If every instrument, at command, or from foreknowledge of its master's will, could accomplish its special work if the shuttle would weave, and the lyre play of itself; then neither would the architect want servants, nor the master slaves." Aristotle: "Politics" I, sec. 4 (Translation by Edward Walford.)

[3] "There is no fact in modern history more easily demonstrated than that the products of steam-driven machinery are mainly consumed by the common people—the masses." Gunton: Principles of Social Economics, p. 147.

"Quand je vous ai prouvé, messieurs, que l'introduction des machines expéditives, telles que le moulin à farine, ne diminue pas les moyens d'existence de la classes laborieuse, et n'a que l'inconvénient, assez grave à la vérité, de changer la nature de ses occupations, je n'ai pas complètement rendu justice aux machines. Le fait est que, dans la plupart des cas, elles sont favorables aux ouvriers mêmes dont elles semblaient sopprimer le travail. Tout procédé expéditif, en reduisant les frais de production, met le produit à la portée d'un plus grande numbre de consommateurs. L'expérience prouve même que le nombre des consommateurs s'augmente dans une proportion bien plus rapide que la baisse du prix." J. B. Say: Cours Complet d'Economie Politique, Tome I, p. 193.

opened the way to a greater number, not only to live and to work,[1] but to develop themselves and to make the most of themselves which their inherent qualities may allow.

With reference to the workers themselves, we may safely say that men who have worked for years with machinery are on the average, quite as strong and healthy and at least as intelligent, as were men employed in the same industries before machine power was introduced. They certainly compare most favorably, too, with the average workman among those who now have little or nothing to do with machinery.

That routine work, which is persisted in and made one's principal occupation long after the worker has fully mastered it and developed his efficiency in that line to the limit of his capacity, tends to narrow the intellectual field of the worker and to depress his spirit, may be freely admitted. The human mind is continually opening to new wants and seeking the means

[1] "In der Behauptung, dass die Maschinen viele Arbeiter brotlos machen, liegt etwas Wahres aber noch mehr Irriges. In gewissen Fällen werden allerdings viele Arbeiter infolge einer neu eingeführten Maschine brotlos, aber ganz falsch ist die Ansicht, dass die Bevölkerung überhaupt durch Einführung des Maschinenwesens vermindert werde. Die Ausdehnung des Maschinengebrauches ist sogar eine der Hauptursachen der gestiegenen Bevölkerung gewesen, denn dadurch wurde die Erzeugung von Nahrungsmitteln, Kleidern und anderen Gütern so vermehrt, dass viel mehr Menschen erhalten werden können. Nicht bloss eine allgemeine Vermehrung der Bevölkerung hat in den vergangenen Jahrzehnten stattgefunden, sondern auch selbst in solchen Gewerben, in welchen die Maschinenanwendung zugenommen hat, ist die Zahl der Arbeiter oft weit grösser geworden." F. G. Schulze: Nationalökonomie, Leipzig, 1856, S. 44. Quoted by Franz Bensing in "Der Einfluss der landwirtschaftlichen Maschinen." S. 5.

of satisfying them.[1] In proportion, therefore, as the ambition of the individual worker and his capacity for accomplishing new and greater tasks, prompt him to advance in any line of activities, just so will he tend to become despondent and dissatisfied and wearied with too long continuance in any routine employment. Under such conditions the health of the strongest worker must eventually give way.

It is to be noticed, however, that a certain amount of routine is good for a person. No one ever acquires any high degree of skill or proficiency in any line of work until he has thoughtfully and systematically repeated its essential features over and over and made the doing of the task a habit,—to be done, when occasion demands, with little or no thought concerning the manner of the doing. The every day business of dressing ourselves, or of walking, would involve an enormous waste of time and patience if we were compelled to learn anew each day; and the still more common routine employment of carrying food to our mouths and of chewing it, always in the same old way, would become unbearable if routine were of itself a thing detrimental to the well-being of persons and always to be avoided.

It is to be noted also, that routine work is not confined to those employments which require the use of machine power. As a matter of fact, machines can be used to advantage only when the thing to be done by the machine is routine work. The tendency is,

"[1] It is absurd to say that human beings can produce too much of everything needed for the satisfaction of human desire, since the satisfaction of one desire but awakens a new and wider desire, and there can be no end to the demands, the cravings, the yearnings of the being we call man." Henry George, Jr.: in *Chicago Record-Herald* of May 3, 1903.

therefore, always to give over to the machine,[1] the routine part of any work and to leave the more varied employment to the person in charge. The business of weaving, by the former hand method and by the present machine method, is a case in point.[2] Routine work is found quite as frequently in other occupations, as for example, in that of book-keeping, or of teaching music, or of repairing boots and shoes. It is accompanied, not infrequently, with heavy and exhaustive labor, as in the case of hod-carriers and of stone-masons. If we look to the business of many of our common laborers on the street, or on the railroads and canals, or at boat-wharves, we shall find many instances of routine employments such as the worst of machine-driven workmen, not only would not, but could not endure.

It is not so much the fact of routine or monotony of work as the far more serious fact of monotony of life which depresses and degrades the workman.[3] The

[1] "New machinery, when just invented, generally requires a great deal of care and attention. But the work of its attendant is always being sifted; that which is uniform and monotonous is gradually taken over by the machine, which thus becomes steadily more and more automatic and self-acting; till at last there is nothing for the hand to do, but to supply the material at certain intervals and to take away the work when finished." Marshall: Principles of Economics (3d ed.), Vol. I, p. 341.

[2] "Nothing could be more narrow or monotonous than the occupation of a weaver of plain stuffs in the old time. But now one woman will manage four or more looms, each of which does many times as much work in the course of the day as the old time hand-loom did and her work is much less monotonous and calls for much more judgment than his did." Marshall: Principles of Economics, (3d ed.), Vol. I, p. 342.

[3] "As Roscher says, it is monotony of life much more than monotony of work that is to be dreaded; monotony of work is an evil of the first order only when it involves monotony of life." Marshall: Principles of Economics, (3d ed.), Vol. I, p. 342.

boy, who is assigned lessons that are too hard for him, is disposed to quit his books, and he languishes if compelled to remain by them. On the other hand, if the tasks are suited to his capacity, and he masters them, he is usually proud of his achievements and anxious to do more; and if, instead of being assigned further work, he is required to do the same problems over and over again for, seemingly, no better object than that of being dutiful, he becomes dissatisfied and discouraged. In either case there is degradation and loss of power.

The grown up man is only an older boy. He delights to learn new things. He wants to be ever moving forward in the satisfaction of new wants; and if for any reason, as from the consciousness that the length of the working day or the intensity of his employment exacts too much for his strength or from a feeling that he is subject to some undue disadvantage, he finds that his natural powers are being over-taxed or that he cannot advance as rapidly as he thinks he should, he becomes dissatisfied and discouraged; and the longer he stays at his post, the less prepared he becomes to go into another employment. Hence arise the despair and abandon which leads to reckless living and, occasionally, to riot.

It is idle to say that the mere fact of working with a machine tends to narrow the intellectual capacity of the worker. As well might one say that it is injurious to a pupil to give attention to the more skillful work of his teacher.[1]

The mere fact of working with a machine and of being compelled to follow its orderly processes, tends

[1] "It is thought that educates,—the contact with quick and fertile minds; and it matters not whether this contact be produced by a voice or a book or a machine: the result is the same." Washington Gladden: Working People and their Employers, p. 20.

to develop in the mind of the operator, unless he be a perfect blockhead, a more or less perfect comprehension of the plan which was in the mind of the inventor. From having a conscious perception of the purpose of the inventor to noting defects in the means provided for the execution of it, is a step so easy and so obvious that it needs no discussion here. Every such conscious perception of an inventor's plan, or purpose, and every notation of defect in the means provided for its execution, involves a mental effort and a development of intellectual power just as certainly as, and, frequently, with far more beneficial results than, does the conjugation of a Greek verb or the reading of a page from the Aeneid. The operator of farm machinery is especially favored in this respect;[1] because, ordinarily he has charge of a complete machine and must understand it in order that he may keep it in repair.[2]

The simple fact that it requires the exercise of a certain degree of intelligence for the successful operation

[1] "Wer jemals eine landwirtschaftliche Maschine in ihrer Thätigkeit beobachtet und acht darauf gehabt hat, wie der Arbeiter sich drehen und wenden muss, wie er die grösste Aufmerksamkeit auf jede Bewegung der Maschine richten muss, wird zugeben, dass sie einen schädlichen Einfluss auf den geistlichen Zustand des Arbeiters nicht hat. Das Umgekehrte ist vielmehr der Fall. Die Arbeiter sind durch die Beschäftigung mit solchen Maschinen viel intelligenter und geschickter geworden, so dass es ihnen nicht nur möglich ist, in der Landwirtschaft einen guten Verdienst zu finden, sondern auch in anderen Gewerben. Ihre Erwerbsthätigkeit ist mit einem Wort durch die Maschinen eine bessere und höhere geworden, so dass ihnen jederzeit der Übergang von einem zum anderen Gewerbe ermöglicht ist. Das ist unstreitig ein Vorteil, den der landwirtschaftliche Arbeiter durch die Beschäftigung mit Maschinen vor dem industriellen voraus hat." —Bensing: Der Einfluss der landwirtschaftlichen Maschinen, S. 76.

[2] "On the whole the effect of the use of machinery has been to raise the intelligence and skill required on the part of those who use it, whether hired laborers or farm owners, and this is said to have resulted in improving the intellectual status of the American farmer."—Rept. of Ind. Com. (1901), Vol. X, p. xiv.

of a machine, together with the well known fact that machine workmen continue to command higher wages than other workmen engaged in the same industries, should be conclusive evidence that the use of a machine does not impair the intellect of the operator. Anyone may be presumed to know that it requires a higher grade of intellect to operate a steam-plow than it does to operate a hoe, and that the operator of the steam-plow commands the higher wage.

It is significant of the mutual relationship between the possession of intellectual power and the ability to operate machinery that, according to the returns of the Twelth Census, the North Atlantic States, having 44.2 per cent of the total population of the country ten years of age and over engaged in manufactures, mechanic arts, trade, and transportation, reported only 15.8 per cent of the total number of illiterates, ten years of age and over, and only 27.9 per cent of the total number of deaths, occurring during the census year, from "injuries by machinery"; while the Southern States (South Atlantic and South Central divisions), having but 16.9 per cent of the total number, ten years of age and over, engaged in manufactures, mechanic arts, trade, and transportation, reported 66.9 per cent of the total number of illiterates, ten years of age and over, and 39.6 per cent of the total number of deaths from "injuries by machinery."[1]

It is safe to say that the people in the Southern States employ, relatively, even less of machinery in agri-

[1] For the number of persons engaged in manufactures, mechanic arts, trade and transportation, see page 93.

For statistics of illiteracy see Twelfth Census, Population II, p. C.

The total number of deaths, reported as resulting from "injuries by machinery," was 333; of these 80 were reported from the North Atlantic States and 132 from the South Atlantic and South Central States —Twelfth Census, Vital Statistics II, Table 7.

culture than they do in manufactures, mechanic arts, trade, and transportation. Accepting this as a fact, and bearing in mind the showing above made touching the matter of education and the personal injuries resulting from the use of machinery, it is not difficult to concur in the opinion of the English writer who held that "the expense of ignorance is the greatest in the obstructions which it presents to the introduction of machinery;" that "notwithstanding the progress of machinery in agriculture, there is probably as much sound practical labour-saving invention and machinery unused, as there is used; and that it is unused solely in consequence of the ignorance and incompetence of the work-people."[1]

THE USE OF MACHINERY AND THE LENGTH OF THE WORKING DAY

The length of the working-day is shorter now than formerly, This shorter working-day is, however, only very indirectly a consequence of the use of machinery. So far as the individual employer is concerned it would be quite correct to say that the shorter working-day is, not so much because of, as in spite of, his use of machinery.

Every employer of labor expects to further his own interests by giving employment to others. Of course it may happen, and doubtless does happen occasionally,

[1] Edwin Chadwick, Esq.: *Journal of the Statistical Society*, Vol. 25, p. 516.

"The less general use of improved machinery in the South than in other sections is cited in partial explanation of the slow rate of agricultural progress in that country and is itself explained by the lack of mechanical skill on the part of the negroes and by the cheapness of labor, which makes it more economical to employ hand labor in many operations which would be more cheaply done by machinery where labor is more expensive."—Rept. of Ind. Com. (1901), Vol. X, p. xiv.

that men offer employment for the sake of the employee, but wages paid for such employment are really charity offerings in disguise. They have no part in a discussion concerning the usual and every-day relations between employers and employees.

In like manner we may say that every employee expects, in return for any service which he renders, to receive a certain payment which shall yield him a net return of satisfaction above sacrifice. Not only does he expect a net return, but he expects a higher net return of satisfaction above sacrifice than he could otherwise secure. In other words, he expects that it will be better or more profitable, for him to undertake the employment offered, on the terms proposed, than to decline it and, perhaps continue unemployed. Unless the workman has such an expectation, he should not undertake the work. It is not only proper,[1] but most desirable that both the employer and the employee should have their expectations realized.

What is the attitude of the parties with respect to each other? Assuming a certain length of working day, the position of the machine-using employer has been well stated by an English factory inspector as follows: "The quantity produced must, in the main, be regulated by the speed of the machinery; it must be the interest of the mill owner to drive it at the utmost rate of speed consistent with these following conditions, viz., the preservation of the machinery from too rapid deterioration; the preservation of the quality of the article manufactured; and the capability of the workman to follow the motion without a greater exertion

[1] "In an ordinary contract both parties may, and usually do, gain by entering into the agreement." Amer. and Eng. Enc. of Law, (2d ed.), Vol. XIV, p. 582.

than he can sustain for a constancy."[1] In short, it is the interest and purpose of the employer to so manage his establishment that he may secure from it the highest net return. He is producing for a market, and the more promptly he can supply the demands of that market the greater are his chances of making a profit; and hence the need for "the utmost rate of speed," and also for the most constant operation of the factors of production consistent with the conditions named. "The highest result with the least expenditure of means,"[2] is the motto of the employer.

One factor, the machine, can work almost continuously day and night; and its efficiency is the same for the twenty-fourth hour as for the first hour or for any intermediate hour. Indeed, except as occasional stops may be requisite in order that the machine be kept in repair, the more continuously it is kept at work the less likely it is to deteriorate and the less likely that it will become worthless by reason of the invention of a better machine. Whether we consider the work of a machine for a day, for a year, or for its whole life-time as a producing agent, it is most effective and yields the highest net return to its owner when operated almost continuously.

The other factor, the workman, cannot work continuously for any great length of time. There must be portions of each day given to rest and recuperation; and the efficiency of the workman in the last hour of a long working-day is much less than in any other hour, unless, perhaps, in the first. In the average employment requiring the use of little or no machinery, we may assume that the first hour's work of each work-

[1] See Karl Marx: Capital, p. 413.

[2] Brooks: The Social Unrest, p. 201.

ing day is worth less than that of the second, or of the third, etc. But after the sixth or seventh hour the workman becomes increasingly less efficient. Moreover, if he works beyond his strength in any one day, and still more, if he works beyond his strength for any considerable length of time, he loses vitality; and loss of vitality, whatever may be the determining cause, means, inevitably, the degradation of the workman and a permanently decreased efficiency.[1]

The employer who is seeking the highest net return from an investment in labor should, therefore, if he is wise, be guided by a very different rule, in fixing the working-day for a man, from that which he should follow in fixing the length of the working-day for a machine.

If the term of employment is for a day only, and fresh workmen can be secured for each succeeding day, it may pay the employer to crowd his employees, to the utmost limit of their strength throughout, perhaps, the full twenty-four hours of the day. But if the term of employment is for a year, or for life, with no chance of getting a substitute, then it will, ordinarily,[2] pay an employer to be more saving of his employees' vitality. He must now look to the preservation of the health and strength of his employees for the longer period of employment. It is only in this way that the employer can secure the highest net return on his investment. We know, however, that employers are sometimes both

[1] Walker: Wages, pp. 81–88.

[2] "Slave-labour, under an intelligent profit monger, may require provision to be made for a full working life, though even in slavery it may sometimes pay to use up a slave by intense toil during a shorter period." John A. Hobson: The Economics of Distribution, p. 162.

unwise [1] and unscrupulous [2] and that even in cases of employment for long periods, employers will, not infrequently, discount the future at too high a rate and overwork their employees. The temptation to do this way is especially strong when free laborers are employed because the services of a freeman are not ordinarily paid for in advance and for the whole period of possible employment, as in the purchase of a slave, but day by day, or month by month, and the death or total disability of the freeman relieves the employer from paying for the latter portion of the stipulated term, that is for that portion of the term when the overworked laborer is least efficient. Moreover, except as provided for by the employer's liability acts, the employer of free labor has no financial interest in the welfare of a workman after the stipulated period of service is in any way terminated.

[1] "I challenge the assumption which underlies the orthodox doctrine of wages, namely, the sufficiency of the sense of self interest. Mankind, always less wise, and too often foolish to the point of stupidity, on the one side, and of fanaticism, on the other, whether in government, in domestic life, in the care of their bodies, or in the care of their souls, do not suddenly become wise in industrial concerns. The argument for keeping a laborer well applies with equal force to the maintenance of a slave." Francis A. Walker: Wages, p. 58.

"It shocks us to-day to hear the allegation that slaveowners once discussed in convention the expediency of using a slave up in six years or four years in a certain occupation, and decided that it 'paid' to use him up in four." Ely: Outlines of Economics, p. 182.

[2] "Certainly, it seldom happens that any one in the position of a monopolist with respect to the purchase of labor power will look ahead for years and ask, Is not the course I am pursuing likely to diminish the labor supply? We do not find any action on the part of the purchaser of labor power which would indicate that this is the case. Take the example of the sweater and his victims. We do not find that he is held back from exercising his full power over them by the fear that he will cut off the future supply of labor power. He thinks that it will be forthcoming from some source; but even if not, he thinks, before the supply dries up I will reap my harvest; I will make my fortune." Ely: Monopolies and Trusts, p. 132.

Ambitious men will even overwork themselves. It is too much to expect that they should, voluntarily, be more solicitous for the welfare of their employees.

We have now to inquire concerning the effect of yoking together the machine and labor factors,—the one yielding the highest net return, when worked almost incessantly, either for short or for long terms of employment; the other yielding the highest net return when worked for longer or shorter periods, according to the length of the term of employment, but always, unless in the case of employment for a single day, when considerable portions of each day are allowed for rest and recuperation. It is like harnessing together a racer and a plow horse. From the standpoint of the employer, the machine and labor factors do not work in harmony. Under any conditions the employer is interested in getting as much service as possible from his employee and, when using machinery, is constantly impelled, according to the amount of his investment in the machine factor[1] to spur on the labor factor to a longer working day.

The position of the employee is radically different from that of the employer. When making a contract for the sale of his labor power, the employee does not seek to establish a long working day. He wants a certain amount of exercise, and he may even be glad to do some work for the pleasure which comes of achievement, but a long working day, or a day of intense or otherwise exhaustive toil, is not desired. Not infre-

[1] "As machinery became more and more costly, the length of the working-day was lengthened until it became, even for women and children, sixteen and eighteen hours in cases not rare. Indeed, it has been generally longer where women and children have been the predominating labor force, because they are less powerful to resist oppression."—Ely: Labor Movement in America, p. 109.

quently, the employee assumes a position antagonistic to the interests of his employer. There remains, therefore, a wide margin within which the interests of employers and employees are adverse to each other; and the immediate effect of the introduction of machinery is rather to widen that area than to narrow it.

It would doubtless be impossible to enumerate all of the causes which have operated to give a shorter working day in the more recent years. Public opinion has doubtless had some influence in this direction; but, for the most part, the various causes have found expression in, and have operated through, factory and labor laws.

Just how far the legislation thus far enacted in behalf of employees has operated to give farm laborers a shorter working day it would, doubtless, be impossible to say. That the farm laborers have, in some degree, profited by such legislation may be fairly inferred from the testimony presented before the recent Industrial Commission and summarized in the report of that Commission as follows: "Returns relative to the hours of daily service show the influence of general labor agitation for shorter hours in shortening the day of rural service. The reduction is very general, and greater where industrial and mechanical enterprise is dominant."[1]

It is to be expected, however, that the working-day should be longer on the farms than in the factories, for the outdoor life and more varied nature of the employment promotes health and makes it possible for farm workmen to continue their work through a given period with, relatively, much less cost of vitality.

That this is true will appear fairly evident from a

[1] Report of Industrial Commission (1901), Vol. XI, p. 82.

consideration of the following table taken from Dr. Amos G. Warner's work on "American Charities."[1]

NUMBER LIVING AT STATED AGES OUT OF 1,000 LIVING AT AGE OF 25.

	Ages			
	35	*45*	*55*	*60*
Farmer[2]	898.5	821.19	730.06	639.54
Shoemaker	908.8	812.45	690.65	591.64
Weaver	920.3	822.78	696.04	581.20
Grocer	923.7	826.68	696.02	617.38
Blacksmith	918.8	804.84	672.02	547.02
Carpenter	905.5	812.18	676.58	576.38
Tailor	883.7	758.17	631.58	544.10
Laborer	902.1	789.35	652.85	557.51
Miner	915.1	810.79	646.97	535.69
Baker	924.1	787.35	620.51	518.04
Butcher	887.0	740.64	569.47	451.41
Innkeeper	861.7	684.99	491.13	395.38

As a matter of fact, the length of the working day, the conditions under which work shall be done, and the wages to be paid in any industry, are questions which must all, ultimately, be determined by economic law[3] and, to a very large extent, independently for each

[1] Warner: American Charities, p. 107.

[2] "The farmers and agricultural laborers are at present among the healthiest classes of the population classified according to occupation. The young farmer for some reason or other suffers a higher mortality than the labourer; but at 35 and upward the British farmer enjoys comforts which are beyond the reach of the labourers."—Farr: Vital Statistics, p. 403.

[3] "If men can produce as much or nearly as much in eight hours as they can in ten, eight hours is destined to become the working day; otherwise not. The owner of a stoneyard in Chicago has stated that his men could do as much work in eight hours as in ten hours. Their work is fatiguing and little or nothing is gained by working the men over eight hours. Eight hours was the day's labor in that yard, and the owner said so far as his business was concerned the eight-hour question had solved itself."—Powers: Labor Making Machinery, p. 33.

industry according to the nature of the work to be done and according to the character of the workers. But the economic law by which they are to be determined is not necessarily the economic law which is most favorable to employers, or to employees, nor even to the interest of employers and employees jointly considered, any more than the policy of our federal government is to be determined by the civil law most favorable to any particular state or section of the Union. Such questions are to be determined by that economic law which is most favorable to the whole social body,—to the state,—to humanity.[1]

[1] "Ausgangspunkt, wie Zielpunkt unserer Wissenschaft ist der Mensch"—Roscher: Grundlagen der Nationalökonomie, S. 1.

[NOTE.—The tables which follow, and upon which the calculations in this study are based, will be found to differ in some particulars from the corresponding tables in the Twelfth Census special report on occupations. The foot-notes connected with the several tables show the sources upon which I relied in making them. Further than this I need add only that my tables were completed early in 1903—over a year before the publication of the census report referred to —H. W. Q.]

TOTAL NUMBER OF PERSONS, TEN YEARS OF AGE AND OVER, IN THE SEVERAL OCCUPATION CLASSES IN 1870, 1880, 1890, AND 1900—CLASSIFICATION OF THE TWELFTH CENSUS[1]

	Agriculture	*Prof. Services*	*Dom. and Pers.*	*Trade and Trans.*	*Mfg. and Mech. Arts*
UNITED STATES					
1900	10,381,765	1,258,739	5,580,657	4,766,964	7,085,992
1890	8,565,926	944,333	4,220,812	3,326,122	5,678,468
1880	7,713,875	603,202	3,423,815	1,866,481	3,784,726
1870	5,948,561	371,098	2,277,587	1,228,823	2,679 854
NORTH ATLANTIC DIVISION					
1900	1,074,412	411,279	1,857,069	1,867,805	3,368,710
1890	1,099,465	299,468	1,467,628	1,316,779	2,788,120
1880	1,048,442	207,551	1,211,958	828,802	2,012,969
1870	1,020,440	139,809	878,064	584,672	1,483,608
SOUTH ATLANTIC DIVISION					
1900	2,032,569	119,360	798,837	422,272	627,653
1890	1,669,014	92,361	581,127	308,751	466,803
1880	1,622,081	62,309	517,429	177,436	298,507
1870	1,272,873	39,778	349,164	118,217	215,740
NORTH CENTRAL DIVISION					
1900	3,508,808	478,237	1,759,936	1,671,015	2,162,917
1890	3,117,043	371,347	1,328,853	1,151,139	1,705,456
1880	2,735,525	230,622	1,025,089	595,791	1,038,096
1870	2,043,984	131,821	652,225	363,638	703,642
SOUTH CENTRAL DIVISION					
1900	3,300,817	152,381	793,549	475,931	487,077
1890	2,321,694	114,263	524,165	315,318	360,374
1880	2,120,525	73,455	464,909	161,449	201,835
1870	1,499,316	46,751	293,287	111,347	145,514
WESTERN DIVISION					
1900	465,159	97,482	371,266	329,941	439,635
1890	358,710	66,894	319,039	234,135	357,715
1880	187,302	29,265	204,430	103,003	233,319
1870	111,948	12,939	104,847	50,949	131,350

[1] The data for the years 1890 and 1900 are taken from the Report of the Twelfth Census, Population II, pp. cxxxv-cxxxvi.

The data for the years 1870 and 1880 are derived from the Report of the Eleventh Census, Population II, pp. cix-cx. Corrections being made as indicated in the Report of the Twelfth Census, Population II, p. cxxvii. The correction is complete except in the case of "Officials of Mining and Quarrying Companies" for the year 1880. These were not separately reported in that year and hence correction was impossible as to them.

TOTAL NUMBER OF MALES, TEN YEARS OF AGE AND OVER, IN THE SEVERAL OCCUPATION CLASSES, IN 1870, 1880, 1890, AND 1900—CLASSIFICATION OF TWELFTH CENSUS[1]

	Agriculture	*Prof. Services*	*Dom. and Pers.*	*Trade and Trans.*	*Mfg. and Mech. Arts*
UNITED STATES					
1900	9,404,429	828,163	3,485,208	4,263,617	5,772,788
1890	7,887,042	632,646	2,553,161	3,097,701	4,650,540
1880	7,119,365	425,947	2,242,309	1,803,629	3,153,692
1870	5,551,593	278,841	1,304,430	1,208,995	2,325,776
NORTH ATLANTIC DIVISION					
1900	1,039,729	270,254	1,165,352	1,629,782	2,629,848
1890	1,078,791	192,797	890,856	1,201,302	2,179,295
1880	1,043,497	136,572	774,767	790,344	1,587,867
1870	1,017,751	95,853	514,160	571,106	1,221,885
SOUTH ATLANTIC DIVISION					
1900	1,697,623	81,949	418,784	389,390	505,345
1890	1,421,695	66,791	271,493	291,228	380,580
1880	1,358,072	49,168	289,342	170,702	252,208
1870	1,088,122	33,572	156,037	115,394	189,468
NORTH CENTRAL DIVISION					
1900	3,408,789	299,297	1,162,678	1,489,968	1,822,671
1890	3,036,880	236,730	854,956	1,076,163	1,456,420
1880	2,720,123	156,419	714,686	582,458	914,347
1870	2,037,688	97,011	402,982	361,354	654,120
SOUTH CENTRAL DIVISION					
1900	2,808,511	109,401	452,563	450,308	417,151
1890	1,997,805	86,914	277,033	304,360	306,933
1880	1,811,486	61,011	283,271	158,314	178,177
1870	1,296,652	41,231	140,623	110,372	132,846
WESTERN DIVISION					
1900	449,777	67,262	285,831	304,169	397,773
1890	351,871	49,414	258,823	224,648	327,312
1880	186,187	22,777	180,243	101,811	221,093
1870	111,380	11,174	90,628	50,769	127,457

[1] See footnote, page 93.

TOTAL NUMBER OF FEMALES, TEN YEARS OF AGE AND OVER, IN THE SEVERAL OCCUPATION CLASSES IN 1870, 1880, 1890, AND 1900—CLASSIFICATION OF THE TWELFTH CENSUS[1]

	Agriculture	*Prof. Services*	*Dom. and Pers.*	*Trade and Trans.*	*Mfg. and Mech. Arts*
UNITED STATES					
1900	977,336	430,576	2,095,449	503,347	1,313,204
1890	678,884	311,687	1,667,651	228,421	1,027,928
1880	594,510	177,255	1,181,506	62,852	631,034
1870	396,968	92,257	973,157	19,828	354,078
NORTH ATLANTIC DIVISION					
1900	34,683	141,025	691,717	238,023	738,862
1890	20,674	106,671	576,772	115,477	608,825
1880	4,945	70,979	437,191	38,458	425,102
1870	2,689	43,956	363,904	13,566	261,723
SOUTH ATLANTIC DIVISION					
1900	334,946	37,411	380,053	32,882	122,308
1890	247,319	25,570	309,634	17,523	86,223
1880	264,009	13,141	228,087	6,734	46,299
1870	184,751	6,206	193,127	2,823	26,272
NORTH CENTRAL DIVISION					
1900	100,019	178,940	597,258	181,047	340,246
1890	80,163	134,617	473,897	74,976	249,036
1880	15,402	74,203	310,403	13,333	123,749
1870	6,296	34,810	249,243	2,284	49,522
SOUTH CENTRAL DIVISION					
1900	492,306	42,980	340,986	25,623	69,926
1890	323,889	27,349	247,132	10,958	53,441
1880	309,039	12,444	181,638	3,135	23,658
1870	202,664	5,520	152,664	975	12,668
WESTERN DIVISION					
1900	15,382	30,220	85,435	25,772	41,862
1890	6,839	17,480	60,216	9,487	30,403
1880	1,115	6,488	24,187	1,192	12,226
1870	568	1,765	14,219	180	3,893

[1] See footnote, page 93.

PER CENT OF PERSONS IN THE SEVERAL OCCUPATION CLASSES OF THE TOTAL NUMBER IN OCCUPATION CLASSES, IN 1870, 1880, 1890, AND 1900.—(CLASSIFICATION OF 1900).[1]

	Agriculture	*Prof. Services*	*Dom. and Pers.*	*Trade and Trans.*	*Mfg. and Mech. Arts*
UNITED STATES					
1900	35.7	4.3	19.2	16.4	24.4
1890	37.7	4.1	18.6	14.6	25.0
1880	44.3	3.5	19.7	10.7	21.8
1870	47.6	3.0	18.2	9.8	21.4
NORTH ATLANTIC DIVISION					
1900	12.5	4.8	21.6	21.8	39.3
1890	15.8	4.3	21.0	18.9	40.0
1880	19.8	3.9	22.8	15.6	37.9
1870	24.9	3.4	21.4	14.2	36.1
SOUTH ATLANTIC DIVISION					
1900	50.8	3.0	20.0	10.5	15.7
1890	53.5	3.0	18.6	9.9	15.0
1880	60.6	2.3	19.3	6.6	11.2
1870	63.8	2.0	17.5	5.9	10.8
NORTH CENTRAL DIVISION					
1900	36.6	5.0	18.4	17.4	22.6
1890	40.6	4.9	17.3	15.0	22.2
1880	48.6	4.1	18.2	10.6	18.5
1870	52.5	3.4	16.7	9.3	18.1
SOUTH CENTRAL DIVISION					
1900	63.4	2.9	15.2	9.1	9.4
1890	63.9	3.1	14.4	8.7	9.9
1880	70.2	2.4	15.4	5.3	6.7
1870	71.5	2.2	14.0	5.3	7.0
WESTERN DIVISION					
1900	27.3	5.7	21.8	19.4	25.8
1890	26.8	5.0	23.9	17.5	26.8
1880	24.7	3.9	27.0	13.6	30.8
1870	27.2	3.1	25.4	12.4	31.9

[1] See footnote, p. 93.

PER CENT OF MALES IN THE SEVERAL OCCUPATION CLASSES OF THE TOTAL NUMBER OF MALES IN OCCUPATION CLASSES IN 1870, 1880, 1890 AND 1900.—(CLASSIFICATION OF 1900).[1]

	Agriculture	*Prof. Services*	*Dom. and Pers.*	*Trade and Trans.*	*Mfg. and Mech. Arts*
UNITED STATES					
1900	39.6	3.5	14.7	17.9	24.3
1890	41.9	3.4	13.6	16.4	24.7
1880	48.3	2.9	15.2	12.2	21.4
1870	52.1	2.6	12.2	11.3	21.8
NORTH ATLANTIC DIVISION					
1900	15.4	4.0	17.3	24.2	39.1
1890	19.4	3.5	16.1	21.7	39.3
1880	24.1	3.2	17.9	18.2	36.6
1870	29.8	2.8	15.0	16.7	35.7
SOUTH ATLANTIC DIVISION					
1900	54.9	2.7	13.5	12.6	16.3
1890	58.5	2.7	11.2	12.0	15.6
1880	64.7	2.3	13.6	8.0	11.9
1870	68.7	2.1	9.9	7.3	12.0
NORTH CENTRAL DIVISION					
1900	41.7	3.7	14.2	18.2	22.2
1890	45.6	3.5	12.8	16.2	21.9
1880	53.5	3.1	14.0	11.4	18.0
1870	57.4	2.7	11.3	10.2	18.4
SOUTH CENTRAL DIVISION					
1900	66.3	2.6	10.7	10.6	9.8
1890	67.2	2.9	9.3	10.3	10.3
1880	72.7	2.4	11.4	6.4	7.1
1870	75.3	2.4	8.2	6.4	7.7
WESTERN DIVISION					
1900	29.9	4.5	19 0	20.2	26.4
1890	29.0	4.1	21.4	18.5	27.0
1880	26.1	3.2	25.3	14.3	31.1
1870	28.5	2.8	23.1	13.0	32.6

[1] See footnote, p. 93.

PER CENT OF FEMALES IN THE SEVERAL OCCUPATION CLASSES OF THE TOTAL NUMBER OF FEMALES IN OCCUPATION CLASSES IN 1870, 1880, 1890, AND 1900 (CLASSIFICATION OF 1900).[1]

	Agriculture	*Prof. Services*	*Dom. and Pers.*	*Trade and Trans.*	*Mfg. and Mech. Arts*
UNITED STATES					
1900	18.4	8.1	39.4	9.4	24.7
1890	17.3	8.0	42.6	5.8	26.3
1880	22.5	6.7	44.6	2.4	23.8
1870	21.6	5.0	53.0	1.1	19.3
NORTH ATLANTIC DIVISION					
1900	1.9	7.6	37.5	12.9	40.1
1890	1.4	7.5	40.4	8.1	42.6
1880	0 5	7.3	44.8	3.9	43.5
1870	0.4	6.4	53.0	2.0	38.2
SOUTH ATLANTIC DIVISION					
1900	36.9	4.1	41.9	3.6	13.5
1890	36.0	3.7	45.1	2.6	12.6
1880	47.3	2.3	40.9	1.2	8.3
1870	44.7	1.5	46.7	0.7	6.4
NORTH CENTRAL DIVISION					
1900	7.2	12.8	42.7	13.0	24.3
1890	7.9	13.3	46.8	7.4	24.6
1880	2.9	13.8	57.8	2.5	23.0
1870	1.8	10.2	72.8	0.7	14.5
SOUTH CENTRAL DIVISION					
1900	50.7	4.4	35.1	2.6	7.2
1890	48.9	4.1	37.3	1.6	8.1
1880	58.3	2.3	34.3	0.6	4.5
1870	54.1	1.5	40.8	0.2	3.4
WESTERN DIVISION					
1900	7.7	15.2	43.0	13.0	21.1
1890	5.5	14.1	48.4	7.6	24.4
1880	2.5	14.4	53.5	2.6	27.0
1870	2.7	8.5	69.0	0.9	18.9

[1] See footnote, p. 93.

FARMING POPULATION IN 1880, 1890, AND 1900.[1]

	Agriculutral laborers		*Farmers, planters and overseers*	
	Male	*Female*	*Male*	*Female*
UNITED STATES				
1900	3,747,668	663,209	5,367,169	307,706
1890	2,556,957	447,104	5,055,130	226,427
1880	2,788,976	534,900	4,172,049	57,002
NORTH ATLANTIC DIVISION				
1900	410,856	3,827	587,550	30,019
1890	353,580	2,277	671,429	17,233
1880	344,512	1,372	666,299	3,041
SOUTH ATLANTIC DIVISION				
1900	780,073	267,518	873,147	66,657
1890	613,407	198,203	773,834	48,241
1880	706,651	244,615	634,464	18,808
NORTH CENTRAL DIVISION				
1900	1,209,612	13,531	2,125,701	84,656
1890	772,455	5,561	2,191,542	73,083
1880	840,966	4,133	1,832,623	10,678
SOUTH CENTRAL DIVISION				
1900	1,189,470	376,361	1,565,384	114,895
1890	716,060	240,477	1,240,801	82,333
1880	849,170	284,537	936,274	23,778
WESTERN DIVISION				
1900	157,657	1,972	215,387	11,479
1890	101,455	586	177,524	5,537
1880	47,677	243	102,389	697

[1] Twelfth Census, Population II, pp. 510 *et seq.*; Eleventh Census, Population II, pp. 306 *et seq.*; Tenth Census, Population, pp. 760 *et seq.*

FARMING POPULATION IN THE SEVEN LEADING CEREAL PRODUCING STATES, IN 1880, 1890 AND 1900.[1]

	Agricultural laborers		*Farmers, planters and overseers*	
	Male	*Female*	*Male*	*Female*
SEVEN STATES				
1900	605,596	6,822	1,022,123	34,114
1890	357,565	2,329	1,057,665	34,202
1880	350,947	1,618	824,362	4,438
ILLINOIS				
1900	183,272	1,687	257,790	10,159
1890	125,137	827	285,644	11,885
1880	150,190	717	279,423	1,754
IOWA				
1900	132,290	1,160	227,482	6,846
1890	73,753	403	236,338	7,515
1880	88,045	354	210,928	973
KANSAS				
1900	88,462	809	172,337	5,682
1890	47,965	234	192,452	6,387
1880	54,725	177	146,988	643
MINNESOTA				
1900	92,889	1,306	152,094	5,402
1890	51,701	457	130,607	3,261
1880	33,852	141	96,128	559
NEBRASKA				
1900	58,760	841	118,330	3,245
1890	34,596	175	129,106	3,186
1880	18,848	210	68,263	400
NORTH DAKOTA				
1900	23,774	419	43,699	1,312
1890	12,157	116	30,109	691
1880[2]	5,287	19	22,632	109
SOUTH DAKOTA				
1900	26,149	600	50,391	1,468
1890	12,256	117	53,409	1,277
1880[3]				

[1] See footnote 1, page 99.

[2] Includes returns from South Dakota.

[3] Included in returns for North Dakota.

AGRICULTURAL POPULATION OF NEW ENGLAND IN 1880, 1890, AND 1900. (CLASSIFICATION OF 1900).[1]

		In Agriculture	
	Total	*Male*	*Female*
NEW ENGLAND			
1900	287,829	277,956	9,873
1890	304,448	299,835	4,613
1880	304,679	303,679	1,000
CONNECTICUT			
1900	44,796	43,247	1,549
1890	45,596	44,830	766
1880	44,274	44,184	90
MASSACHUSETTS			
1900	66,551	64,669	1,882
1890	69,720	68,790	930
1880	65,215	64,988	227
MAINE			
1900	76,923	73,791	3,132
1890	81,284	79,821	1,463
1880	83,437	83,194	243
NEW HAMPSHIRE			
1900	38,782	37,224	1,558
1890	42,279	41,658	621
1880	45,122	44,931	191
RHODE ISLAND			
1900	10,957	10,673	284
1890	11,630	11,446	184
1880	10,986	10,951	35
VERMONT			
1900	49,820	48,352	1,468
1890	53,939	53,290	649
1880	55,645	55,431	214

[1] Data for 1890 and 1900 taken from Report of Twelfth Census, Population II, pp. cxxxv-cxxxix. As to data for 1880 see footnote 1, p. 93.

ACREAGE IN ALL FARM CROPS,[1] AS REPORTED IN 1880, 1890, AND 1900.[2]

	1900	*1890*	*1880*
UNITED STATES			
All Farm Crops	272,493,449	214,623,412	164,830,442
Cereals	184,983,220	140,378,857	118,805,952
Hay	61,691,069	52,948,797	30,631,054
Cotton	24,275,101	20,175,270	14,480,019
Cane	386,986	374,975	227,776
Tobacco	1,101,460	695,301	638,841
Hops	55,613	50,212	46,800
NORTH ATLANTIC DIVISION			
All Farm Crops	21,957,338	22,155,561	22,024,776
Cereals	8,957,452	8,869,351	9,913,840
Hay	12,919,041	13,205,321	12,026,364
Cotton			
Cane			
Tobacco	53,281	44,080	44,852
Hops	27,564	36,809	39,720
SOUTH ATLANTIC DIVISION			
All Farm Crops	26,481,330	23,730,022	22,135,566
Cereals	16,964,662	14,790,108	15,575,701
Hay	2,161,201	1,925,753	1,128,420
Cotton	6,842,489	6,746,292	5,165,175
Cane	47,223	32,888	24,778
Tobacco	465,754	234,981	241,480
Hops	1		12
NORTH CENTRAL DIVISION			
All Farm Crops	155,167,564	122,950,427	85,760,874
Cereals	119,324,898	90,584,015	70,154,743
Hay	35,676,042	32,220,468	15,490,866
Cotton	45,749	57,991	32,116
Cane			
Tobacco	120,516	86,789	78,038
Hops	359	1,164	5,111

[1] By "all farm crops" is meant the following crops: Barley, buckwheat, cane, corn, cotton, hay, hops, oats, rice, rye, tobacco, and wheat. These are all of the crops for which comparable data can be had and they constitute nearly the whole of the crop acreage. The only crops of any consequence, from the standpoint of acreage, and not included are: Broomcorn, flax, hemp, potatoes, vegetables, and orchard fruits.

[2] The data of hop acreage in 1879 and 1889 are taken from the Report of the Eleventh Census, Agriculture II, p. 91 *et seq.* All other data are taken from the Report of the Twelfth Census, Agriculture II, p. 63 *et seq.*

	1900	*1890*	*1880*
SOUTH CENTRAL DIVISION			
All Farm Crops	53,593,467	36,178,553	29,744,199
Cereals	31,521,429	20,222,568	19,350,718
Hay	3,883,662	1,913,532	633,433
Cotton	17,386,807	13,370,987	9,282,728
Cane	339,708	342,087	202,998
Tobacco	461,855	329,379	274,322
Hops	6		
WESTERN DIVISION			
All Farm Crops	15,293,750	9,608,849	5,165,027
Cereals	8,214,779	5,912,815	3,810,950
Hay	7,051,123	3,683,723	1,351,971
Cotton	56		
Cane	55		
Tobacco	54	72	149
Hops	27,683	12,239	1,957

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